CURRENT SCIENCE

Vol. XIV] DECEMBER 1945 [No. 12

SCIENTIFIC RESEARCH IN NATIONAL PLANNING

THIS war has proved beyond doubt that human valour and determination cannot compensate for scientific and technical efficiency, and that a nation with a low *per capita* income and limited industrial development, even though large in numbers, has little chance of honourable existence in this world. The aim of every post-war reconstruction in India, therefore, should be the removal of these two weaknesses—a low *per capita* income and limited industrial development.

It will be idle to ignore the fact that there are powerful leaders in India who have been so impressed by the evils of the modern world that they do not hesitate to declare that the introduction of the Western methods for increasing our national income should be resisted and that it is no business of the State to help scientific and technological development. They would prefer the culture of cottage industries, peasant farming, and living on subsistence level with its inevitable doses of famine and pestilence to the immense wealth but inhuman greed of modern societies. It is hoped that they would soon recognise, now that the Fascist world has tumbled down, that the powerful tools of science are capable of doing immense good if handled for the benefit of humanity; that in these days of rapid communications, we cannot live in isolation from the rest of the world even if we wish to do so; that life in India will be stagnant if we run counter to the characteristics of the present age which consist in applying the principles and products revealed by scientific research to industry and agriculture.

It is also unfortunate that our powerful industrial magnates and *entrepreneurs* do not always believe that scientific and technical research is necessary for the industrial development of a country. They consider that all that is needed is to decide on general grounds, if the country has the potential resources in raw materials, power and transport facilities which will justify the establishment of any particular industry, and then import into the country the necessary machinery and experts for the purpose. They are in favour of providing such technical education which will enable the industry to be run by indigenous talent after a period of probation under foreign experts; but they would stop at research as being more in the nature of a luxury. To them the history of the dyestuff industry should be an object lesson. The first synthetic dye was made in England by Perkin, but the industry soon found a congenial home in German soil. In Germany, the practical outlook of businessmen was enthused by that faith in scientific knowledge which came from first-hand knowledge. Thus twenty long years of painstaking research were necessary at a cost of more than a crore of rupees before Bayer's process for the synthesis of indigo could be commercialised; but once it was done, the fate of the natural indigo of Bihar was sealed and it disappeared from the world's market in another twenty years. The attitude in Great Britain was one of complacent "wait and see"; and the result was, that when the first world war broke out, she had no dyestuff industry of any importance. As that war

progressed, it was soon realised that this dependence on Germany for dyes was an intolerable weakness of the British chemical industry. Modern war depends for its successful prosecution on an abundant supply of a large variety of chemicals; and a dyestuff and fine chemical industry must be considered an integral part of every defence programme. The British Government, under Lloyd George, took immediate and far-reaching steps. Beginning with a large subsidy for the formation of the British Dyestuff Corporation, millions of pounds were spent on developmental research in every branch of the industry. Later on, the importation of dyes and even intermediates were prohibited. As a result, Sir Gilbert Morgan could claim in 1939 with justifiable pride that out of the five most fundamental discoveries in dyestuff chemistry since 1921, the world owed three to British talent. In this war, the British Dyestuffs factories not only produced their home requirements, but had in addition a considerable export trade.

In India we are now very anxious to increase the productivity of the soil by use of synthetic fertilisers; and ammonium sulphate factories on a large scale are being built in Travancore and Bihar. It is, therefore, of topical interest to recall that exciting venture of the late Prof. Haber when in 1909 he demonstrated before the Badische Chemical Engineers that it is possible to obtain small quantities of ammonia by direct combination of nitrogen with hydrogen. Millions of pounds had to be spent before this discovery could be exploited commercially; and today, synthetic ammonia, apart from its value in war, constitutes the biggest single item in the fertiliser industry with an annual production of more than 150 crores of rupees. It is also a proof that the direct return of one fruitful piece of long-range research pays back many times over the cost of ninety-nine which may not find useful application. The conviction has now become universal that, a nation which habitually applies scientific method and knowledge to industry and agriculture, can only seize the more spectacular achievements of science in its economic life. "No nation can also depend only on the efforts of other nations for the purpose of promotion of knowledge. This is not only because such dependance is an ignoble parasitism, but also because in the field of international relations, no less than in national life, the power that comes from knowledge comes from its early and rapid use and from close contact with men who have created such knowledge."

It is, therefore, a matter of considerable satisfaction that the Report of the Industrial Research Planning Committee, appointed by the Government of India, contains a bold five-year programme for the development of industrial and scientific research, at an estimated expenditure of Rs. 6 crores. The building and equipping nine specialized laboratories, including a technological institute on the lines of the Massachusetts Institute of Technology; a two crores of rupees grant for strengthening the scientific departments of India's eighteen universities and the training of seven hundred research workers in five years—these are some of the recommendations made by the Industrial Research Planning Committee.

In its Report the Committee recommends the setting up of a national research organisation to be called the National Research Council which would be authorized to initiate the Five-Year Plan immediately.

Recurring annual expenditure is estimated at 2 crores of rupees and the Committee recommends that half this amount be met by a grant from the Government and the other half by a proposed cess on industries, including railways.

The Committee recommends that the National Research Council should consist of representatives of scientific bodies, universities, industry, labour and administration, with the Government of India's Member for Planning and Development as *ex-officio* President. The Council will organize and maintain national laboratories and specialize research institutes; stimulate and encourage research activities by Industry and in co-ordination with all existing research institutes and departments of Government, undertake the planning of research programmes on a nation-wide basis. The Council will also serve as a national trust for patents and will set up a Board of Standards and Specifications.

Apart from the establishment of a National Chemical and a National Physical Laboratory, which is recommended at an estimated cost of 40 lakhs of rupees each, the other specialized laboratories proposed to be set up are, in order of priority, those for Food Technology, Metallurgy, Fuel Research, Glass and Silicate Research, Oils and Paints, Leather and Tanning, Industrial Fermentation and an Electro-Chemical Institute.

Industries will be encouraged to set up their own research associations on a corporate basis and the expenditure incurred on research will be exempted from income-tax assessment.

It is also proposed that Research Councils on the model of the National Research Council be set up in all Provinces and major States.

A small executive body called A Research Board will be responsible for the administration of the Council's work. The Board will prepare comprehensive plans of research programmes and will take an active part in the establishment of research institutions by industries.

We hope the Government of India will give due consideration to this report and funds will be made available for industrial and scientific research on adequate scale in the near future.

POONA UNIVERSITY

THE announcement by the Government of Bombay to give effect to the recommendations of the Maharashtra University Committee in due course on certain terms and conditions is most welcome.

The Bombay Presidency Education Conference under the presidency of Sir Narayan Chandavarkar adopted a resolution in favour of regional universities for the presidency as long back as 1917. In 1924, the Committee on University Reform, presided over by Sir Chimanlal Setalvad, recommended the creation of universities in Maharashtra, Gujerat, Karnatak and Sind, and reported that conditions were ripe for the setting up of some form of university for Maharashtra in Poona. In 1933, as a result of representations made by certain leaders of Maharashtra, a conference of educationists and representatives of other interests was convened to discuss the policy of gradual establishment of regional universities in the Province of Bombay. As this conference could not come to unanimity of opinion in favour of any scheme, nothing further was done. In 1941, a representative deputation waited on the Adviser to H. E. the Governor of Bombay to press the question of a University for Maharashtra and as a result, a committee, presided over by the Right Honourable Dr. M. R. Jayakar, was appointed to consider the question of the establishment of a University for Maharashtra in all its aspects.

The Jayakar Committee did monumental work for a period of over a year and submitted a report to Government which will stand for a good length of time as a document of great value. The Committee has considered in great detail all types of university education and evolved a type which incorporates many good features of various types with due deference to the requirements of Maharashtra and to the several financial difficulties. The Committee has recommended the establishment of a University for Maharashtra in Poona, to be called "The University of Poona". At Poona, there is to be built up a strong teaching and research centre. As far as possible, most of the post-Intermediate work is to be done in Poona with the pooling of the resources of all the existing institutions. Colleges outside Poona which are situated within the Marathi-speaking area of the Province should teach up to the Intermediate stage. The University is to be of an affiliating type only up to the Intermediate stage but there is a proviso for a large measure of University supervision even at this stage. This is most desirable and very welcome. The teaching for higher classes is to be the direct responsibility of the University. Special provision is to be made for the systematic supervision over the lodging of students. There is to be an Appointments Board also. One important aspect of the work of the University will be the introduction of Marathi as a medium of instruction and examination. This is a feature which will be watched with interest all over the country. The several authorities of the University are similar to those elsewhere. A special feature, however, is the fact that elections have been reduced to a minimum and the academic and non-academic bodies are clearly defined.

Poona is one of the largest educational centres in India and has several well-established colleges and research institutions. The contribution of the several scholars from Poona to the advancement of knowledge is well known. The climate of Poona is very conducive to intensive work for the greater part of the year. Marathi is one of the few well-developed languages of the country with a good and growing literature. The establishment of a university at Poona is, therefore, most appropriate. We look forward to its establishment as a welcome step for the advancement of higher education and research in the Province of Bombay in particular and in India in general. We have no doubt this will relieve the great strain that is placed on the University of Bombay which is now catering to the vast and varied requirements of the whole Province and Sind.

THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY recently celebrated the centenary of the Royal College of Science, one of its constituent colleges—the other two being the Royal School of Mines and the City and Guilds College. The Royal College of Chemistry, the original of the Royal College of Science, was sponsored at a meeting held on July 29th 1845, in the early days at the dawn of an Industrial Age. It has been staffed by such eminent scientists as Sir W. H. Perkin and Sir William Tilden, who made striking and fundamental contribution to our knowledge in pure and applied chemistry. The college has played a notable part in winning the last War, and is looking forward to geting into its peace-time stride, and helping British Industries to re-establish themselves in the world markets. "The fundamental need is the highest degree of efficiency in our production. No exporter can win markets unless the quality, price and design enable him to sell the goods. Price is a measure of our efficiency. We cannot and must not try to attain a low price by cutting wages. We must attain it by increased efficiency and cutting costs."—This is the ardour with which the College enters its second century.

GOLDEN JUBILEE OF THE DISCOVERY OF X-RAYS

THE Travancore Medical Association celebrated the Golden Jubilee of the discovery of X-rays on Monday, the 5th November 1945. *Sachivottama* Sir C. P. Ramaswamy Iyer, who presided on the occasion, said: "The whole question of X-rays and all that they mean is a matter which cannot escape the attention of any one who is studying the working of the Universe either from the spiritual or the physical aspects. The X-rays and cosmic rays are the result of the perpetual disintegration that goes on in the Universe which our ancients connoted by the expression *Pralaya*. The emanation that causes the birth of things is action or manifested energy. Matter is now disputed to be not matter at all. The whole world is immaterial, it is *Maya* in the transcendental sense. To our ancients this truth came as part of intuition. The question that comes to most of us is, 'Is vibration and not substance, the ultimate fact of the universe, the *Nadabrahma* of which our ancients spoke?'"

Dr. H. Parameswaran, surveying the progress of "X-rays in Industry", referred to the development of the X-ray technique during the past fifty years and its applications to the identification of precious stones, detection of crimes and examination of minerals and castings.

Dr. C. S. Venkateswaran briefly reviewed the fundamental role of X-rays in physics and chemistry. By the discovery of X-rays, Prof. Röntgen placed in the hands of scientists a radiation having a wavelength less than one-thousandth of the visible light. When a beam of X-rays falls on matter, every atom is covered by a full wave. It may truly be said that the atomic age of which we hear so much to-day was ushered in by the discovery of X-rays. In its wake followed the discovery of the electron, the atomic theory and indeed all the fundamental facts which form the basis of Modern Physics. By the irradiation of matter with X-rays, two things may happen. It may result in the ejection of the outer electrons. The study of these photo-electrons has contributed greatly to the development of the atomic theory. Alternately X-rays may set the electrons of the atoms in vibration; thus every atom becomes a secondary source of radiations. The study of these secondary X-rays helped to investigate not only the number of electrons in an atom but also how they are distributed in space. In the same way, it afforded a deep insight into the arrangement of atoms in molecules and of molecules in condensed media. By far the most extensive field of its application has been to the investigation of the atomic arrangements in crystals, X-rays reveal not only the perfection in the internal architecture of the crystals but also the surface and volume imperfections of even the slightest degree. X-rays thus touch the heart of matter. These fields of investigations are likely to be extended a hundredfold by the recent improvements in X-ray technique by means of which rays having a wavelength as short as γ-rays could be produced in the laboratory. He also referred to the study of molecular vibrations by X-ray methods—a field full of promise for the future.

Dr. A. O. Jacob dealt with the surgical and therapeutic values of X-rays and the manifold uses to which they are put by medical men for diagnosis and treatment of tumours and eruptions.

Sir C. V. Raman at the outset paid a glowing tribute to Conard William Röntgen, the greatest benefactor of mankind. Speaking of the role of pure science and scientists, Sir Raman said: "Too often to-day the world is separated into pieces by national and international hatreds, antagonisms and war. Science alone among the forces living to-day brings us together. It is the power of man to discover a great truth by intuition that raises him in his own estimation. Thus, for example, it was a supreme triumph of inuition that led Prof. Louis de Broglie to discover the dual nature of matter. Intuition cannot, however, be a substitute to experimentation. Nature reveals her great secrets only to her devout worshippers like Prof. Röntgen. The man of science, like a true devotee, lays his *Atman* at the feet of the deity. Every day and, in fact, every hour, his life is a supreme act of sacrifice.

The greatest leaders of the world, the apostles of humanity, are the men and women like Röntgen and Mme. Curie, who made a free gift of their discoveries to the whole humanity. The true justification of science, if there is any justification, is that it binds the nations of the world together and not separates them and he who forgets this truth is unworthy of the name of scientist.

The discovery of X-rays is an outcome of the supreme courage to do and dare. It heralded a new era of scientific progress. It was a wonderful reward which came to a man seeking in the solitude of his laboratory to understand the secrets of Nature. By this discovery the old world was abolished and a new world ushered in where the hope of mankind was to be brightened and his suffering lessened. It is in fact the one discovery, which produced a thrill in the whole world of science and fired the imagination and enthusiasm of a whole generation of workers. In its biological effects X-rays gave a meaning to what is meant by life. The contributions to physics and chemistry are profound and affected every branch of science. We may regard the modern atomic age as the true child of Röntgen's wonderful discovery fifty years ago."

C. S. VENKATESWARAN.

LETTERS TO THE EDITOR

PRODUCTION OF THE *LIGHT-EFFECT* IN CHLORINE UNDER ULTRA VIOLET

Previous results[1] regarding the current decrease Δi on irradiation of chlorine and other gases, subjected to a silent discharge in Siemens' tubes (also in semi-ozonisers), referred to various spectral regions from 7,100 to about 3,700 Å, the short wave-length limit for glass and also to X-rays from a Coolidge tube with a tungsten target.[2] This phenomenon has now been observed under the ultra-violet.

An all-glass ozoniser, about 100 mm. long, 50 mm. in diameter and 5 mm. width for the annular space, had a 1·5 mm. thick quartz window cemented on one end. It was filled with chlorine at 300 mm. pressure and excited by potentials varied by 0·3 kV at a time in the range 4 to 6 kV (r.m.s.) at 50 cycles frequency, and irradiated in the *end on* position. The threshold potential of the system[3] was about 4·2 kV. The inner electrode of the ozoniser was filled with a concentrated solution of potassium permanganate in order to absorb all light; the ozoniser was also screened against external light by wrapping in black paper, except at the quartz window. The gas under the discharge was therefore, irradiated only by a narrow beam, of the size of, and along, the annular space. The appreciable values for the *light-effect* expressed as a percentage of the conductivity in the dark $\%\Delta i$ (*vide infra*), despite this restricted irradiation, indicate therefore, the large magnitude of this phenomenon producible under optimum conditions.

During one of the series of observations made with a 100-watt incandescent (glass) bulb as a light source, $\%\Delta i$ first increased from 22 to a maximum of 24, and then decreased to 13 as V, the applied potential, was 4·5, 4·8 and 5·6 kV respectively. Superposition over the quartz window of 2 mm. thick glass plates showed that the corresponding $\%\Delta i$ diminished in accordance with earlier general results for the influence of intensity on the *light-effect*.[4,5] Thus, for example, with two glass filters and the quartz, $\%\Delta i$ decreased from 16 to 11, as V increased from 4·2 to 5·6 kV.

Using a large-size quartz mercury vapour lamp and only the quartz window, $\%\Delta i$ was 35 and 42 respectively at the values of V mentioned above; $\%\Delta i$ was a maximum, *viz.*, 55 at 5·1 kV. Results were interesting when the ultra-violet was cut off appreciably, by the addition of a 2 mm. glass over the quartz. The $\%\Delta i$ with the above light-source and potentials falls to 17 and 16 respectively, with a maximum of 25 at 5·1 kV. These values are sensibly similar to those observed under the visible as indicated above. This is further brought out by the fact that the $\%\Delta i$ with two glass filters and the quartz was about 23

as a maximum; and decreased with V on either side, being, *e.g.*, 17 and 13 at 4·5 and 5·6 kV respectively. It follows, therefore, that the relatively high values for $\%\Delta i$ with only the quartz window, may be attributed to the high frequencies in this radiation, and not so much to the much greater over-all intensity of light from the mercury lamp compared with the bulb. It is also seen that the frequency is a more important determinant of this *light-effect* than the light-intensity; and that, with a strong radiation, a change of intensity does not diminish $\%\Delta i$ appreciably, as long as the light-frequency is substantially unaltered.[5] These results are also in accord with an earlier finding, that $\%\Delta i$ attains to a maximum near the threshold potential;[6] it would now appear that the position of this maximum in respect of V, depends upon the nature of the exciting light.

Chlorine absorbs selectively chiefly in the region (which is the source of its colour), from 6400 Å or perhaps a little longer, to about 2500Å with a pronounced maximum at 3340Å;[7] it also absorbs between 1900 to 1560 Å.[8] The much greater *light-effect* now observed in the ultra-violet may, therefore, be associated with the circumstance that it also represents largely the characteristic absorption spectrum of chlorine, and especially that part in which comparatively, the extinction coefficients are high.[7,8,9] On the short-wave side of 4785Å which is the convergence limit, the absorption by chlorine is *continuous*.[7,8] From Franck's well-known theory[10] of light absorption by especially diatomic molecules, which has been abundantly verified, it is extremely likely that a primary effect of irradiation of chlorine in the above regions is the production of normal and excited atoms of chlorine in the discharge space. These have a large 'electron affinity';[11] at a given V, the corresponding electronic velocity U- is, therefore, expected to be reduced, due either to electrons attaching to chlorine atoms, so as to give atomic ions of reduced mobility;[12] or/and U- might decrease owing to a viscous drag by the atmosphere of electro-negative chlorine atoms.[13] It has been shown by the writer that U- determines the discharge current i.[14] The occurrence, therefore, of a current decrease Δi under irradiation, which constitutes the *light-effect*, follows.

It may be emphasized, however, that the production of the *light-effect* in air and hydrogen in the visible;[1] that $\%\Delta i$ in chlorine in the yellow, *e.g.*, radiation from a sodium vapour lamp (whose absorption by chlorine is minimum) is as much as 15 per cent., which is greater than a relativity more absorbed and intense red band, *viz.*, 6100 to 7100 Å, *viz.*, 3·5 per cent.; and especially the observation that at 7700 Å and longer, where absorption by chlorine is presumably negligibly small, Δi is about 2-3 per cent., suggest that the *light-effect* may not be entirely a consequence of selective light-absorption, but also a frequency or a quantaic phenomenon.

Chemistry Department, S. S. Joshi.
Benares Hindu University,
October 16, 1945.

1. Joshi, "Presi. Address," *Chem. Sec., Indian Sci. Cong.*, 1943. 2. —, *Curr. Sci.*, 1944, 13, 278. 3. —, *Nature*, 1944, 154, 147. 4. Deo, *Indian Journ. Phys*, 1944, 1², 80–85. 5. Joshi, *Curr. Sci.*, 1945, 14, 36. 6. —, *Proc. Indian Acad. Sci.* (communicated). 7. Halbn, and Siedentopf, *Z. Physik Chem.*, 1922, 103, 71. 8. Cordes and Sponer, *Z. Physik*, 1930, 61, 334. 9 Joshi and D o, *Nature*, 1943, 151, 361. 10. Franck, *Trans. Faraday Soc.*, 1926, 21, 536. 11. —, *cf.*, pp. 179, 182, 186. Foote and Mohler, *Origin of Spectra* (New York, 1922). 12. Townsend, *Electricity in Gases* (Oxford, 1915). 13. J. J. and G. P. Thomson, *Conduction of Electricity Through Gases*, 1 (Cambridge, 1928). 14 Joshi, *Trans. Faraday Soc.*, 1929, 25, 125-128; 141, 142.

MAGNITUDE OF THE EARTH'S CHARGE

The earth's charge Q, has been estimated to be $4{\cdot}5 \times 10^5$ coulombs of negative electricity. But this value has been computed on the basis of a homogeneous, internal geophysical structure, merely giving rise to an electric field of the order of 100 volts per metre at the earth's surface, this having been multiplied by the square of the earth's radius to give the foregoing value. It will, however, be seen that such an assumption is erroneous in the light of modern theory.

It is generally agreed that, before it assumed the present structure,[1] the earth was one rapidly rotating spherical mass of metallic fluid which later cooled at the surface to form an upper crust of thickness approximately 2,900 km., and the still hot internal residual core of radius 3,500 km., there being a spherical "layer of discontinuity" several kilometres thick between the two. Assuming, in accordance with the modern view in general, that the earth's magnetism is caused by the rotation of a negatively charged core,[2] and noting that the earliest records do not show that the net value of the field generated has changed to any extent since then, we may state that the core is rotating at almost the same angular velocity as at the time of the transformation; that the crust is rotating at an angular velocity which could have been modified only by the change which took place in its density; and that the angular momentum of both must be relatively the same as before.

It is known that the density of the earth's crust is 5, that of the core[3] is 8, and that the angular velocity of the crust is 7×10^{-5} radians per second. Knowing the volume of each and hence the mass m, the angular momentum is easily calculated. Equating the two we obtain 22×10^{-5} as the angular velocity w, of the core.

Since the earth's magnetic axis is symmetrically inclined at an average angle of 20° to the geographic, we must now suppose that the core is rotating independently of the crust and around a different axis. Also, the magnetic axis (produced) is situated at well-defined points in the north and south latitudes of the earth's surface. This would indicate that the magnetic *axis itself* is rotating, along with the earth, about its midpoint near the earth's centre. To an observer located on the earth, therefore, the entire earth's core must, for the greater part, rotate with the same angular velocity w, as we have obtained above. Now

the magnetic potential M, of a point[4] with polar co-ordinates r, θ with reference to a charged sphere such as the one in the earth's interior, is given by

$$M = \frac{Qwa^2\cos\theta}{5cr^2}$$

where a is the radius of the sphere (the core), and c is the velocity of light. But $M = Hr$ in which H is the average value of the computed earth's magnetic field. Hence

$$Q = \frac{6cHr^3}{wa^2\cos\theta}$$

and substituting appropriate values for a point near the core's pole, we have $Q = 2{\cdot}5 \times 10^{14}$, and not $4{\cdot}5 \times 10^{5}$ coulombs as is commonly assumed.

Again Petrucci[5] has shown that the earth's charge is a variable quantity, and that it changes directly as the atmospheric potential gradient. But since the latter may vary from one to four times its basic value in the course of a day, we may conclude that the earth's charge also varies from one to four times the above value. It is important to note that *there will be a strong electrostatic field* at the surface of the earth's internal core of Q divided by the square of the core's radius, namely, 6×10^{8} volts per cm. which must undergo a similar periodic variation in magnitude.

Colaba Observatory,
Bombay, ALFRED B. ARLICK.
October 8, 1945.

1. Jeffreys, H., *The Earth*, II Edition, Chap. 5, 1929. 2. Elsasser, W. M., *Phys. Rev.*, 1939. 55, 497. See also Haalck, H., *Gerl. Beit.. z. Geof.*, 1938, 52, 3–4, 243–69. and Vestine, E. H., *Bull. Internat. U. of Geod. & Geoph.*, 1940, 11, 354–59. 3. Jeffreys, H., *The Earth*, II Edition, 1929, Chap. 7. 4. Swann, W. F. G., *Encyc. Brit.*, 1943, 21, 965. 5. Petrucci, G., *Com. Geod. e. Ge. of Boll.*, 1937, 7, 228–40.

NEW ULTRA-VIOLET BANDS OF MERCURY IODIDE

THE ultra-violet bands ascribed to the mercury iodide molecule by various investigators were recorded in a previous paper[1] dealing with the analysis of two of these band-systems. Further investigations using transformer and high-frequency oscillator discharges through mercury iodide vapour reveal the existence of three new systems which have not been reported previously. They lie in the regions λ 2550-2500, λ 2435-2385 and λ 2345-2300, and may be designated as F_1, F_2, F_3-systems respectively. F_1 comprises of about twenty red degraded bands some of which have intense and sharp edges towards the violet. F_2 consists of a succession of closely spaced bands degraded to the red with the interval between successive bands diminishing towards the region of longer wave-lengths. F_3 has the resemblance of the brief system of mercury bromide analysed previously[2] and consists of about fifteen diffuse and mostly headless bands. The analysis of these systems and their correlation with the other known bands of the HgI molecule will be dealt with in detail elsewhere.

V. RAMAKRISHNA RAO.
K. R. RAO.

Andhra University,
Guntur,
November 28, 1945.

1. Rao, Sastry and Krishnamurthy, *Ind. Jour. Phy.*, 1944, 18, 323. 2. Rao and Ramachandra Rao, *ibid.*, 1944, 18, 281.

OSCILLOGRAMS OF VALVE CHARACTERISTICS

IN the course of a study of the dynamic transfer characteristics of radio valves, by means of the cathode-ray oscillograph, a few interesting features were observed, which are described herein. In this method the signal input (50 C.P.S. and 1,000 C.P.S. sine wave in our case) is applied to the control grid and to the X-plates of the oscillograph, while the anode output is applied to the Y-plates.

It is in general recognised that the dynamic ($e_g = i_p$) characteristics become looped or closed curves, if the load impedance has a

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

reactive component, when phase changes are introduced between the X and Y components of the variables. But our studies reveal that even if pure resistance are used in the anode and grid circuits, closed dynamic curves can be obtained, if the grid resistance is higher than certain maximum values. Under these conditions when the grid charge leaks away but slowly, the response of the plate voltage can be delayed, developing a sort of hysteresis effect as shown in Figs. 1, 2 for the 6 C 5 R.C.A. detector, amplifier and 3, 4, for the 6 K 7 super control amplifier pentode. Curves 1 and 3 are taken with correct grid resistors, while with 2 and 4, the grid was imperfectly earthed and may be described almost floating.

Again the negative slope of the screen grid valve characteristics when the screen voltage is higher than the plate voltage, has the effect of reversing the closed curves, as illustrated in Figs. 5 and 6, which were taken with the tetrode 46.

B. D. CHHABRA.
H. R. SARNA.
MAHINDER PARKASH.

Physics Laboratories,
Government College,
Lahore,
September 21, 1945.

COLORIMETRIC ESTIMATION OF IRON WITH RESACETOPHENONE—OXIME

SNELL[1] describes sixteen reagents for the colorimetric estimation of iron and of these a dozen are organic compounds. Since then several other organic reagents have been added to the list. Recently Howe and Mellon[2] investigated the iron-salicylaldoxime colour reaction spectrophotometrically and found that pH was a critical factor and, with solutions buffered with ammonium acetate, the colour obeys Beer's Law over a wide concentration range of iron.

Astin and Riley[3] drew attention to the expensiveness of salicylaldoxime as a reagent and in their investigations on the determination of copper, to cut down the cost, they adopted a procedure involving the production of the oxime *in situ* so that isolation became unnecessary. It must, however, be pointed out that salicylaldehyde itself is an expensive item. Further, Howe and Mellon (*loc. cit.*) found that dilute aqueous alcoholic solutions of this oxime (0·1 per cent.) were not quite stable. This adds to the cost of the reagent.

The present authors found that resacetophenone-oxime also gives a similar purple colour with ferric iron and the sensitivity was comparable with that of salicylaldoxime. Resacetophenone is neither costly nor difficult to prepare being obtained in very good yield from resorcinol, glacial acetic acid and anhydrous zinc chloride. This compound has also been introduced as a reagent for the detection of iron by Cooper.[4] The oxime (colourless crystals, m.p. 198-200° d.) is obtained easily by the usual method and is cheaper than salicylaldoxime. Resacetophenone-oxime is readily soluble in alcohol and is not precipitated by large dilution with water. Aqueous alcoholic solutions (0·5 per cent.) are quite stable for long periods. Control of pH is necessary with this reagent also. Buffering with ammonium acetate was found to give satisfactory results. Experiments carried out with Kletts' colorimeter and artificial illumination showed that the limits for the balancing method, with a final dilution of 25 ml. after developing colour, was 2·0 to 0·1 mg. of iron. Because of the powerful illumination, at the still lower concentrations of iron, the colour shades were too light for satisfactory matching.

The colour characteristics and the applicability of Beer's law could not be studied spectro-photometrically at present. This investigation will be taken up and the results published later on.

K. NEELAKANTAM.
M. V. SITARAMAN.

Departments of Chemistry,
Andhra University, and the
Presidency College, Madras,
October 6, 1945.

1. Snell, "Colorimetric Methods of Analysis," 1936, **1**, 283. 2. Howe and Mellon, *Ind. Eng. Chem., (Anal).* 1940, 448. 3. Astin and Riley, *J.C.S.*, 1933, 314. 4. Cooper. *Ind. Eng. Chem. (Anal).*, 1937, **9**, 334; *of Annual Reports*. 1937, 487.

THE NUTRITIVE VALUE OF MILK AND CURDS

THE status of milk as the only food for infants carries with it the implication that it contains all the essential nutrients. Even for children, adolescents and adults, milk is almost an essential article of diet. An enormous amount of work has been done in Western countries to ensure the production and distribution of milk under hygienic conditions. Pasteurization is the process of choice for rendering the milk free of micro-organisms and at the same time retaining most of its nutritive value.[1] In India the conditions, however, do not permit strict control of the distributon of milk and as an alternative measure of safety every housewife boils the milk before it is used. This process causes destruction of some of the essential nutrients, such as vtamin A, C and carotene.[2] Unlike the Western countries the curds prepared by fermenting milk, forms an important constituent of most Indian dietaries. Yet the nutritive value of curds has formed the subject of few investigations. The studies in the bacteriology of milk have been undertaken to find out mainly the ways and means to prevent the growth of pathogenic organisms such as *Mycobacterium tuberculosis* and the organisms belonging to the enteric group.

According to Supplee,[3] the whey from the rennet curds is a rich source of vitamin B complex. It also contains, provitamins D and K in addition to minerals and hormones. Curds, therefore, would be a better source of nutritive material than whey on account of its additional protein and fat content. During the pro-

cess of curdling by fermentation the milk may be invaded by a variety of micro-organisms some of which may be pathogenic; but under controlled conditions it is a seat of various strains of streptococcus lactis, yeast and gram negative lactobacillus. Investigations of Najjar, Holt, Elvehjem and others have shown that such micro-organisms are able to synthesize some vitamins.[4] According to them such micro-organisms if found in the gastro-intestinal tract of animals, including human beings, would synthesize some vitamins[5,6,7] which could be utilized by the host in case of deficiency. It is, therefore, logical to believe that the micro-organisms responsible for curdling of milk would also synthesize, during their growth, some vitamins at the cost of other nutrients from milk. A probing investigation was, therefore, thought essential in order that the changes in the nutritive value of milk after curdling might receive a thorough study. The knowledge thus obtained would also be helpful in preparing curds of a high nutritive value.

As a preliminary measure the estimations of some members of vitamin B complex were undertaken. Curds was prepared by the usual household procedure. Samples of fresh whole milk were obtained from the local shop. The milk was boiled and cooled till it was only slightly warm. It was then inoculated with a very small quantity of preformed curds and left undisturbed for 24 hours at room temperature. By that time curds had formed. The sample of the milk as well as the curds from it were analysed for their vitamin contents by fluorimetric and colorimetric methods. The results are given in the following table.

TABLE I
Thiamine, Riboflavin and Nicotinic acid contents of Milk and Curds

Sample No.	Thiamine μg per gm.		Riboflavin μg per gm.		Nicotinic acid μg per gm.	
	Milk	Curds	Milk	Curds	Milk	Curds
1	..	..	0·79	1·39	0·63	0·30
2	..	..	0·69	0·89	0·67	0·38
3	..	..	0·69	1·32	0·59	0·25
4	..	..	0·86	1·22	0·63	0·26
5	..	..	0·90	1·15	1·75	1·00
6	..	..	0·95	1·15	2·50	1·06
7	0·40	0·52	..	..	2·37	0·69
8	0·43	0·52	..	..	2·25	0·63
9	0·24	0·27	0·59	0·79	0·88	0·50
10	0·21	0·27	0·73	0·86	0·88	0·38
11	0·31	0·37	0·63	0·89	0·88	0·38
12	0·30	0·37	0·59	0·79	0·81	0·44
13	0·30	0·32	..	..	1·00	0·38
14	0·29	0·37	..	..	1·13	0·50
15	0·32	0·37	..	..	1·00	0·61
16	0·31	0·32	..	..	0·89	0·50

The results are interesting inasmuch as the riboflavin content was found to increase and nicotinic acid to decrease due to fermentative changes. The changes in thiamine were not so marked. The results of these experiments show that it would be interesting to extend the study to the influence of fermentative curdling on other nutrients in milk such as proteins, fats and minerals. Moreover such data would be extremely useful if studies are carried out using individual micro-organisms for fermentation. Further work is in progress and will form the subject of detailed communications later on.

R. G. CHITRE.
V. N. PATWARDHAN.

I.R.F.A. Nutrition Research Unit,
Seth G. S. Medical College,
Parel, Bombay 12,
October 6, 1945.

1. Kon, S. K., *Nature*, 1941, **148**, 607. 2. Deco, M., *Cmpt. Rend. Soc. de Biol.*, 1939, **130**, 819. 3. Supplee, G. C., *Industr. and Engin. Chem.*, 1940, **32**, 238. 4. Wegner, M. I., Booth, A. N., Elvehjem, C. A., and Hart, E. B., *Proc. Soc. Exptl. Biol. Med.*, 1940, **45**, 769. 5. Welch, A. D., and Wright, L. D., *J. Nutrition*, 1943, **25**, 555. 6. Najjar, V. A., and Holt, L. E., Jr., *J. Am. Med. Assoc.*, 1943, **123**, 683. 7. —, *Ibid.*, 1944, **126**, 357.

SOME ANALOGUES OF D.D.T.

A RECENT publication[1] by E. A. Prill, A. H. Hartzell and J. M. Arthur on the alkoxy analogues of D.D.T., necessitates the publication of the results which we have already obtained in the condensation of chloral with various aromatic substances.

1. Chloral condenses to give D.D.T. type of compounds with anisole (m.p. 96°), *o*-cresol methyl ether (m.p. 94-96°), *p*-cresol methyl ether (m.p. 160°), resorcinol dimethyl ether (m.p. indefinite, decomposes before melting), thymol (m.p. 201°), *p*-chloroanisole (m.p. 146°) and bromo-benzene (m.p. 146°). All the m.p. are with decomposition.

2. Chloral condenses to give R-CHOHCCl$_3$ type of compounds with *m*-cresol methyl ether (m.p. 110°), hydroquinone dimethyl ether (m.p. 166°) and β-naphthol (no m.p.).

3. Chloral condenses to give amorphous noncrystallisable substances with all phenols (except phenol and thymol), veratrol, thymol methyl ether, α-naphthol methyl ether, β-naphthol methyl ether and naphthalene.

4. Chloral did not condense with iodo benzene and *m*-dichloro benzene.

5. Bromal did not give D.D.T. type of compounds with any of the above substances. With alkoxy benzenes, however, bromal gives compounds of the type R-CHOHCBr$_3$.

A detailed description of these compounds along with their insecticidal properties will be published in due course.

G. D. SHAH.
K. C. KSHATRIYA.
S. R. PATEL.
K. S. NARGUND.

Gujerat College,
Ahmedabad,
November 10, 1945.

1. *Science*, 1945, **101**, 464, No. 2627.

A NOTE ON THE ESSENTIAL OIL FROM GINGER SCRAPINGS

THE gingers of commerce are chiefly obtained from India, China and Jamaica. Though ginger is cultivated in many parts of India, the best ginger is obtained from the Malabar Coast. In Travancore alone, about 25,000 acres are under ginger and the quantity exported is about 3,000 to 4,000 tons.

The rhizomes are submitted to an elaborate process of cleaning and bleaching before marketing in several grades like white ginger, rough unbleached, rough bleached, etc. In preparing the best quality ginger, the rhizomes are scraped to remove the outer skin. Large quantities of these scrapings accumulate and these are generally wasted. These scrapings have been reported to give an essential oil.[1]

Rao, Sudborough and Watson[2] as well as Moudgill[3] have distilled the scrapings and reported the constants and yield but data about the distillation under reduced pressure and constituents are not available. The oil is now shown to resemble ginger oil since it contains camphene, β-phellandrene and Zingiberene, all of which are present in ginger oil.

EXPERIMENTAL

50 Lbs. of the air-dry scrapings were obtained fresh, from North Travancore and distilled in a copper still with water (hydrodistillation). The distillate gave a light yellow oil (yield 0·8 per cent. on air-dry material).

Physical and chemical constants of the oil are given in Table I.

TABLE I

Author's Sample		Rao, Sudborough and Watson	Moudgill	Pure ginger oil
Yield	0·8% air dry	3·45 (on dry basis)	0·9% (air dry)	
Density (30° C.)	0·8905	0·8822 (at 15° C.)	0·8816	0·875—0·886
Ref. Index (30° C.)	1·4859	1·4988 (25° C.)	1·4862	1·4795—1·4855
(a)D	—5·2	—39·2	—9·85	—28 to 50° C.
Acid value	0·90	2·1	1	0—2
Ester value	6·10	7·7	10	0—15
Acetyl value	72·2	49·8	103	33·42

Distillation under reduced pressure.—60 c.c. of the oil were distilled under reduced pressure (8-10 mm.). The physical constants and other details of the fractions are given in Table II.

TABLE II

Fraction No.	Temperature	Weight in gm.	Density 30° C.	Refractive index	Rotation in 5 cm. tube
1	80– 90°C.	8·2	0·8670	1·4670	+ 25·72
2	90–100°C.	6·0	0·875	1·4700	+ 19·32
3	100–110°C.	2·20	0·8800	1·4750	+ 5 10
4	110–120°C.	2·40	0·8840	1·4756	+ 4·00
5	120–130°C.	4·8	0·8860	1·4825	+ 1·57
6	130–140°C.	6·8	0·8890	1·4910	+ 16·93

Fractions 1, 2 *and* 3.—These were mixed together and distilled at atmospheric pressure and separated into four fractions (Table III).

TABLE III

Fraction No.	Temperature °C.	Weight in gms.	Density 30° C.	Ref. index 30° C.
A	30—160	4·2	0·862	1·4640
B	160—165	3·6	0·864	1·4651
C	165—170	3·0	0·876	1·4660
D	170—175	2·1	0·883	1·4690

Fractions A and B were separately tested for camphene by conversion into isoborneol[4] by heating with glacial acetic acid and 50 per cent. of sulphuric acid and then converting the acetate by alcoholic potash. They gave isoborneol (m.p. 212° C.).

Fraction C, after another distillation, gave β-phellandrene-nitrate (m.p. 101-102° C.)[5] with sodium nitrite and glacial acetic acid.

Fraction D did not give any crystalline products.

Fractions 4 *and* 5 were treated for alcohols but none has been identified.

Fraction 6 contains Zingiberene. This fraction was distilled under reduced pressure (10 mm.) and the portion distilling over 128-132° C. (over 75 per cent.) gave the nitrosite (m.p. 97-98° C.) and hydrochloride (m.p. 168-169° C.).[6]

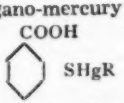
Further work is in progress.

The author acknowledges his indebtedness to Dr. K. L. Moudgill, Director of Research, for his keen interest in this work.

Central Research Institute,
Trivandrum, N. S. VARIER.
November 9, 1945.

1 and 2. Rao, Sudborough and Watson, *Jeurl. Ind. Inst. Sci.* 3. Moudgill, K. L., *J. Ind. Che. Soc.* 4, 5 and 6. Parry, "The Chemistry of Essential Oils and Artificial Perfumes". 3rd Edn. 2, pp. 40, 60 and 72.

CHEMOTHERAPY OF SOME ORGANO-MERCURY COMPOUNDS—THEIR ACTIVITY AGAINST STAPHYLOCOCCUS AUREUS

J. WALDO[1] prepared some organo-mercury compounds of the following type 

where R is an alkyl or aryl group, by reacting alkyl mercury halides with thio-salicylic acid. He found them to be very active against staphylococcus aureus; and in fact the sodium derivative of the ethyl compound is sold in the market under the trade name of "Merthiolet" (product of Lily & Co.).

With the idea that the presence of -N  S- group will add to the bactericidal property of the compound we prepared the following two series of compounds :

(*i*) AcHN  SHgR

(*ii*) O_2N  SHgR

where R is an alkyl group.

When mercurials of the type RHgX, where X is a halogen radical, reacts with a mercapto-acid HSR′, a double decomposition occurs,

$$RHgX + HSR' \rightarrow RHgSR' + HX.$$

We prepared our compounds by the same methods :

(*i*) AcNH  SH + RHgI → AcNH  SHgR + HI

(*ii*) O_2N  SH + RHgI → O_2N  SHgR + HI

Bacteriological Test.—The bactericidal tests of the organo-mercury compounds are carried out by agar cup method on staphylococcus aureus. 15 c.c. of nutrient agar are put in on each test tube, the tubes are then sterilised at 15 lbs. pressure for 30 minutes. Before testing, the sterilised agar tubes are melted and cooled to near about 45° C. The tubes are then charged with 0·1 c.c. of 24-hour culture of staphylococcus aureus and then poured into sterilised petri-dishes. They are allowed to harden and a hole was bored in the agar with a sterile cork-borer. The cup was then filled with drug solution. Since most of the drugs are not soluble in water, olive oil emulsion was adopted in every case. A control test was performed with olive oil and it was found to be inactive against the staphylococcus aureus. The petri-dishes were incubated for 24 hours and the zone of inhibition was clearly noted.

The serial dilution of each compound was tested and the maximum dilution which showed inhibition is shown in the following table.

TABLE I

Compound	M.P.	Maximum dilution which is active against staphylococcus aureus
1. AcNH  SHgMe	185°	1,00,000
2. AcNH  SHgEt	176°	1,000,000
3. AcNH  $SHgC_3H_7$	155°	over 1,000,000
4. AcNH $SHgC_4H_9$	150°	over 2,000,00
5. AcNH $SHgC_5H_{11}$	144°	100,000
6. AcNH $SHgC_7H15$		10,000

Since the chemicals were not available the hexyl-compound could not be prepared.

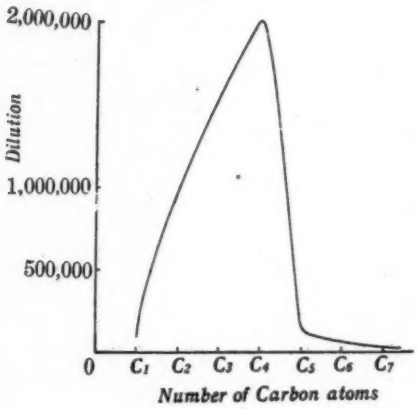
TABLE II

Compound	M.P.	Maximum dilution which is active against staphylococcus aureus
1. O_2N  SHgMe	130°C.	1,000,000
2. O_2N  SHgEt	124°	1,000,000
3. O_2N  $SHgC_3H_7$	90°	10,000
4. O_2N  $SHgC_4H_9$	65°	10,000
5. O_2N  $SHgC_5H_{11}$	60°	1,000
6. O_2N  $SHgC_7H_{13}$		nil

Since the chemicals were not available the hexyl-compound could not be prepared.

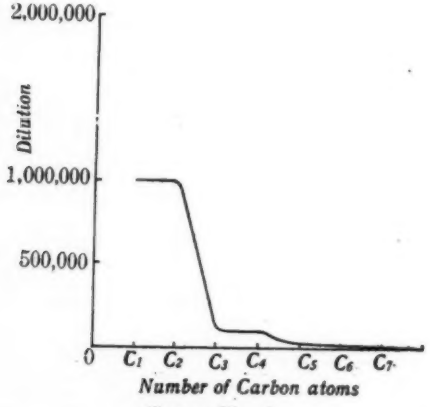
An interesting point may be observed from Table I that the activity of the compounds increases with the increase of the number of carbon atoms in the side chain, upto a certain number and then again falls. It is shown graphically in Graph No. 1.

In Table II it can be seen that the activity of the compounds decreases with the increase



GRAPH No. 1

of the number of carbon atoms in the side chain, which is shown graphically in Graph No. 2.



GRAPH No. 2

Our thanks are due to Prof. P. C. Guha and Dr. N. N. De, for their kind interest during the course of this investigation.

R. K. BHATTACHARYA.
AJOY GUPTA.

Pharmacology Unit,
Indian Institute of Science,
Bangalore,
November 1945.

1. White, *J. Amer. Chem. Soc.*, 1920, **42**, 3555. 2. Waldo, *Ibid.*, 1931, **53**, 892. 3. Barnot and DeKay, *J. Amer. Pharm. Assoc.*, 1943, **31**, 294.

AN INSTANCE OF GRAPES-POISONING

IT is well known that meat, fish and milk are most important but vegetables, cereals and very occasionally fruits, may be responsible for cases of 'food-poisonings' to ensue. It is equally well known from statistics available that only a small percentage of food-poisoning (3·9 per cent.) cases comprise those of the fruits and vegetables origin. And it must be admitted that cases of microbial poisoning (metallic poisonings occasioned by erosion of the containers are reported to have taken place) in acid fruits and vegetables are relatively unknown. Yet one positive instance of grapes-poisoning had come under our observation and study.

During March 1943, two adults who had partaken a purchase of fresh Nasik grapes showed fairly severe signs of acute gastro-intestinal disturbances; they had only a passing suspicion on grapes, but on our request, however, they sent a sample of their fæces and the remaining supply of grapes to our laboratory for examination. The grapes on macroscopic examination looked very attractive indeed, being fresh and "lively", green-yellow in colour. Almost synchronously, a member on the staff of our College became a victim, presumably of grapes-poisoning. Being a biologist with some information on food-poisoning, he reported the case immediately and sent a bunch of grapes for examination and report thereon. This bunch appeared much the same as the other sample received before so much so that they should be regarded as collected from the same vineyard. All the three victims of poisoning had identical types of symptoms to complain, which principally consisted of intestinal pains and explosive evacuations of diarrhœic fæces one half to two hours after the consumption of the grapes.

The samples of fæces on naked eye examination appeared to be whitish to yellowish-green in colour and were more watery than normal. The fæces and the grapes were then cultured (grapes after treating them with a dilute solution of mercuric chloride as per the technique of Harrison and Barlow) on Endos, Czapek and Blood agar plates. Duplicate sets were made and one set was kept at the room temperature (27° C.), the other incubated at body temperature (37° C.). After the incubation, three organisms of likely ætiological relationship with the disease were picked up and subjected to detailed examination for establishing their identities. Two of them were Gram-negative and short bacteria and the third was an unusual looking yeast culture. The Gram-negative bacteria were easily identified as (1) *Escherichia coli communis* (significant in the report as they were persistently isolated from the grapes and not from the fæces); (2) *Pseudomonas æruginosa* (Bact. pyocyaneus). The yeast culture after some difficulty was spotted as a *Cryptococcus* variety (resembling closely *Cryptococcus plimmeri*, described by Guilliermond), an organism pathogenic to guinea-pigs on intraperitoneal inoculation.

Thus the rare instance of grapes-poisoning proved to be possibly a case of mixed infection of relatively acid-tolerant types of micro-organisms having no apparent relationship to each other: but there is no doubt whatsoever

about the pathogenic actions of the three species referred above.

J. V. BHAT.
MISS R. N. REPORTER.
F. FERNANDES.

Microbiology Department,
St. Xavier's College,
Bombay,
September 25, 1945.

1. Bergey, D. H., *et al.*, *Manual of Determinative Bacteriology*, 1939. 2. Guilliermond, A., *The Yeasts*. Translation by F. W. Tanner, 1920. 3. Harrison, F. C., and Barlow, B., *Centr. Bakt. II Abt.*, 1907, **19**, 264–72.

ROLE OF MANGANESE IN THE FORMATION OF VITAMIN C AND CAROTENE IN PLANTS

VARIOUS factors have been reported in literature to affect vitamin C formation in plants. It is found to be favoured by potash fertilization[1] or by application of calcium nitrate[2] but to be retarded by nitrogen fertilization.[3] Little evidence, however, has been adduced regarding the influence of manganese on vitamin C or carotene formation in plants. Hester[4] observed an increased formation of ascorbic acid in tomatoes grown on soil high in available manganese, but Lyon and Beeson[5] failed to find any appreciable change in vitamin C content of tomatoes grown in solution cultures under manganese treatment. On the other hand Rudra[6] noted in its presence an enhanced production of ascorbic acid by animal tissues—from glucose and by germinated seeds. Manganese, as has been pointed out by earlier workers, plays a vital role as a catalyst in the physiological processes of the plant, e.g., in photosynthesis and nitrogen assimilation,[7] in oxidising enzymes[8] and in various other aspects.[9] Its action as a catalyst has been stressed in the oxidation of organic matter.[10]

An investigation was carried out by the author on *Amaranthus gangeticus*, grown in pot-cultures with local soil low in available manganese. Below are presented the results (average of several replicates) obtained for the control and four treatments, A, B, C and D, of manganese, the amounts applied as $MnSO_4 4H_2O$ being 0·05, 0·1, 0·2 and 0·3 gms. respectively per pot (6 lbs.). The vitamin C estimations in the leaves were made by the method of Harris and Olliver,[11] carotene by that of Moore[12] and manganese according to Piper.[13]

From the results (*cf.* Table), the formation of carotene seems to have been uninfluenced by the treatment while that of vitamin C has been affected to various degrees by the added manganese, a significant point being that it is encouraged upto a certain concentration of added manganese beyond which additional concentrations become increasingly harmful. This action seems to run parallel with its action in promoting the plant-growth and is thus indicative of its overall influence on the metabolic activities of the plant. Note may also be made in this connection of the increasing absorption of manganese by the plant in direct relationship with the treatment. It may act directly as a coenzyme or activator of the enzymatic system responsible for the biosynthesis of vitamin C in plants from carbohydrates, or indirectly through its overall influence on the metabolic activities of the plant. Considerable further work is, therefore, needed before the mechanism through which the vitamin C formation occurs in the plant and the role played by manganese therein are elucidated.

Soil Treatment	Total green wt. yield in gm.	Manganese content of leaves in p.p.m.	% increase in the Mn content over control	Vitamin C content in mg. per 100 gm. of fresh material	% increase in vit. C content over the control	Caroten econtent in μ gm. of fresh material
Control	63·14	109·4	..	253·1	..	98·82
A	76·73	136·8	25·04	352·3	39·19	103·1
B	68·40	145·7	33·17	299·4	18·31	102·9
C	62·69	152·6	39·49	238·3	− 5·848	99·65
D	51·31	161·2	47·34	225·0	−11·10	101·0

The author wishes to express his indebtedness to Prof. V. Subrahmanyan for his keen interest and kind encouragement in the work as also for valuable discussions.

Department of Biochemistry,
Indian Institute of Science,
Bangalore, Y. B. RANGNEKAR.
November 3, 1945.

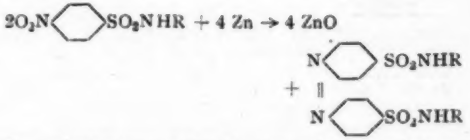
1. Hester, J. B., *Amer. Fert.*, Nov. 1941, **93**. 2. Hausen, S. von., *Biochem. Z.*, 1936, **288**, 378. 3. Jones, W. W., *et al.*, *Science*., 1944 **99**, 103. 4. Hester, J. B., *Science*, 1941, **93**, 401. 5. Lyon, C. B., and Beeson, K. C., *J. Amer. Soc. Agron.*, 1943, **35**, 166. 6. Rudra, M. N., *Nature*, 1944, **153**, 743. 7. McHargue, J. S., *J. Amer. Chem. Soc.*, 1922, **44**, 1592. 8. Bertrand, G., *Compt. rend.*, 1905, **141**, 1255. 9. Brenchley, W. E., *Biol. Rev.*, 1943, **18**, 159. 10. Iyer, H., Rajagopalan and Subrahmanyan, *Proc. Ind. Acad. Sci.*, 1935, **11B**, 108. 11. Harris, L. J., and Olliver, M., *Biochem. J*, 1942, **36**, 155. 12. Moore, L. A., *Ind. Eng. Chem. A. E.*, 1940 **12**, 726. 13. Piper, C. S., "Soil and Plant Analysis," (Univ. of Adelaide), 1942.

STUDIES IN THE SYNTHESIS OF SOME SUBSTITUTED BENZENESULPHONAMIDES. PART III.—A SIMPLE NEW METHOD OF SYNTHESIS OF SOME N-SUBSTITUTED AZOBENZENE 4, 4'-DISULPHONAMIDES

MANY unsymmetrical azobenzene sulphonamides have been made by diazotising a suitable amine and coupling it with a second amino or phenolic compound.[1] But few symmetrical azobenzene-4, 4'-disulphonamides have so far been reported and these have been made by the sulphonation of azobenzene followed by conversion to the corresponding sulphochloride and treating the latter with a suitable amine to form substituted amides.[2–4].

It is surprising that no attempts have been made so far to directly reduce a nitrobenzenesulphonamide to the corresponding azo-bis compound in the manner of the preparation of azobenzene from nitrobenzene.

The present paper describes the successful application of this simple method to the production, in almost theoretical yields, of eight such azo-bis compounds using the corresponding nitrobenzenesulphonamides referred to in Part II of this series.[5]



The substances analysed correctly for nitrogen by the modified Kjeldahl method of Part II.[5]

As, however, the nitrogen content of the azo and the corresponding hydrazo compounds is very nearly the same, the reduction equivalents of the compounds using stannous chloride were determined, thereby obtaining a positive confirmation of the azo structure of these compounds, the reduction equivalents of the hydrazo being double those of the corresponding azo compounds. For this purpose, a weighed quantity of the azo compound was boiled with an excess of standard stannous chloride solution in an atmosphere of carbon dioxide under reflux during about an hour till the azo compound completely dissolved. The excess of stannous chloride was titrated against standard iodine solution. In all cases the equivalents approximated to the theoretical value for the azo compounds showing the remarkable stability of the azo compounds to further reduction in spite of the excess of zinc used.

The accompanying table summarises the analytical data of the eight azo-bis compounds synthesised in this work.

Azo-derivative	Yield %	M.P. in °C.	Percentage of Nitrogen		Stannous Chloride Equivalent	
			Calcd.	Found	Calcd.	Found
$[= N.C_6H_4.SO_2NH_2]_2$ [2–4,6–7]	95	307	16·4	16·28	85	86
$[= N.C_6H_4.SO_2NHCH_3]_2$	87	248–49	15·21	15·19	92	94
$[= N.C_6H_4.SO_2NHC_2H_5]_2$	85	230·5	14·13	13·85	99	111
$[= N.C_6H_4.SO_2NHC_{10}H_7(-\alpha)]_2$	85	267	9·45	8·91	148	160
$[= N.C_6H_4.SO_2NHC_{10}H_7(-\beta)]_2$	96	265·5	9·45	9·14	148	156
$[= N.C_6H_4.SO_2N\langle^{CH_3}_{C_6H_5}]_2$	93	214–15	10·76	10·22	130	116
$[= N.C_6H_4.SO_2N\langle^{C_2H_5}_{C_6H_5}]_2$	97	212·5	10·21	9·86	137	146
$[= N.C_6H_4.SO_2NH.C_6H_4.SO_2NH_2]_2$	80	312	12·9	2·2	162	161

The general procedure adopted was to treat the nitro-compound, suspended in sufficient alcohol, with three atomic proportions of powdered zinc and an excess of 30 per cent. aqueous sodium hydroxide solution. The mixture was refluxed for about five hours. The product separated as an insoluble sodium salt. The whole reaction mixture was evaporated to dryness, neutralised with 7 N sulphuric acid and filtered. The precipitate was well washed with water and then alcohol and in some cases crystallised from the latter, yielding orange-coloured crystalline substances.

My thanks are due to Mr. P. Ramaswami Ayyar for valuable suggestions and guidance, and to Dr. P. C. Guha for kind interest.

Dept. of Pure & Applied Chemistry,
Indian Institute of Science,
Bangalore, (MISS) R. J. IRANI.

December 4, 1945.

1. Northey, *Chem. Rev.*, 1940. **27**, 129–38. 2. Limpricht, *Ber.*, 1881, **14**, 1356. 3. Laar, *Ibid.*, 1881, **14**, 1928. 4. Huang-Minlon, *et al.*, *J. Chinese Chem. Soc.*, 1942, **9**, 57-60; *Chem. Abs.*, 1944, **38**, 1216. 5. *Curr. Sci.*, 1945, **14**, 126. 6. Scudi, *J. Am. Chem. Soc.*, 1937, **59**, 1480. 7. Seikel, *Ibid.*, 1940, **62**, 1214.

ETHER ACETIC AS A FUMIGANT

DURING the last twenty years much attention has been paid to the use of the fumigants for the control of insect-pests of the stored products. Some of these fumigants have proved to be very promising. But in India little work has been done to study the use of fumigants. After a series of trials it was found that among the fumigants tried, "ether acetic" was a promising fumigant. The results of my small-scale experiments are presented here so that the interested workers may try it on large scale and confirm my view of its use on a commercial basis.

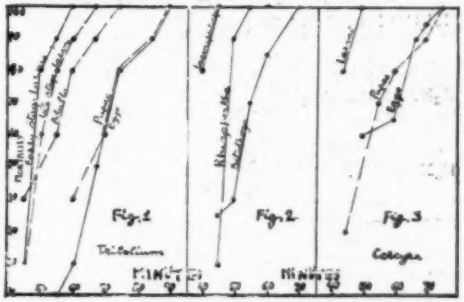
'Ether acetic' has not been used so far as a fumigant. It contains less than 80 per cent. pure ethyl acetate, and about 18 per cent. ethyl ether. Neifert *et al.*,[1] and Back and Cotton[2] have experimented with ethyl acetate, either as such, or in a mixture form with carbon tetrachloride but the ether acetic of commerce has not been experimented upon Ether acetic is a colourless, clear, watery fluid, with a characteristic pungent smell. It is acid to litmus, miscible in all proportion with alcohol, chloroform, oil and ether. It is soluble in water, being more soluble at lower temperatures than at high temperatures. It is non-poisonous to human beings, and does not stain metal, wood or textile fabrics.

The experiments with ether acetic have been carried out on a laboratory scale. The experimental insects were taken in a small petri-dish and covered with cotton-wool. The dish was buried in a tank (glass) of dried fruits. Near the top of the tank was hung, from its lid, a flat dish containing ether acetic. No special precautions were taken to make the lid air-tight. For every observation a separate set was taken. In those cases in which the mortality was below 100 per cent. the experiments were not repeated. When the mortalities reached 100 per cent., the experiments were repeated at least six times, with different varieties of fruits. A record of temperature and humidity of the atmosphere was retained throughout the period of experiments. The following insects were used in the experiments: *Tribolium castaneum* Hbst (eggs, early larvæ, late larvæ, pupæ and adults), *Rhizopertha domenica* Fab. (adults) *Læmophlœus* (adults), *Sitotroga cerealella* Oliv. (early larvæ), and *Corcyra cephalonica* Staint. (eggs, larvæ and pupæ). Adequate controls were run side by side. The dose of the fumigant remained constant, while the period of exposure was varied. The dried fruits used for the experiments were raisins dates, figs, walnuts and cashew-nuts.

Tribolium.—All the eggs were killed within 90 minutes' exposure. The early stage larvæ were killed in much shorter period, *viz.*, 100 per cent. mortalities in 60 minutes. The late stage larvæ appear to be more resistant than the early stage larvæ but less resistant than the eggs (100 per cent. mortality in 67 minutes). The pupæ are more or less as resistant as the eggs (100 per cent. mortality in 90 minutes). The adults are less resistant in comparison either to the eggs or to the pupæ, but more resistant than the larvæ (100 per cent. mortality in 75 minutes).

Rhizopertha adults succumb to the action of the fumigant within 55 minutes. The fumigant is equally effective against *Læmophlœus* adults (100 per cent. mortality in 45 minutes), *Sitotroga larvæ* (100 per cent. mortality in 70 minutes), and *Corcyra* (the time taken for 100 per cent. mortality in the case of eggs 75 minutes, larvæ 50 minutes and pupæ 75 minutes).

The mortalities which take place after an exposure for shorter periods than mentioned above are shown in the graph.



Ether acetic is an effective fumigant for controlling insect-pests of dried fruits. A dose of $\frac{1}{2}$ oz. per 6 cubic feet of space is sufficient to achieve 100 per cent. mortality in case of *Tribolium castaneum, Rhizopertha domenica, Læmophlœus, Sitotroga cerealella* and *Corcyra cephalonica.*

The work was carried out in the laboratory of the Imperial Entomologist, New Delhi.

Agricultural Research
Laboratories, Gwalior, R. RAKSHPAL,
October 15, 1945.

1. Neifert, Cook and others, *U.S., Bull.*, 1925, 1313.
2. Back and Cotton, *J. Econ. Ent.*, 1924, **17**, 663.

STUDIES IN THE SYNTHESIS OF SOME SUBSTITUTED BENZENESULPHONAMIDES PART. IV—SYNTHESIS OF TWO NEW N^1-SUBSTITUTED *p*-ACETAMINO-BENZENESULPHONAMIDES AND THE CORRESPONDING FREE *p*-AMINO COMPOUNDS

IN connection with the preparation of the azo compounds of Part III,[1] a review of the final reduction products, namely, the corresponding aminobenzenesulphonamides, revealed that *p*-aminobenzenesulphon-, methyl and ethyl-anilides and the corresponding N^4-acetyl derivatives have not been synthesised so far. Their synthesis was, therefore, undertaken.

The method employed consisted of the condensation of *p*-acetaminobenzenesulphochloride (1 mole.) with methyl- and ethyl-anilines (each 2 moles) respectively, in alcoholic solution. The acetamino compounds were isolated and subsequently hydrolysed by boiling with 10 per cent. aqueous hydrochloric acid to the free amino compounds in the usual manner.

The equivalents of the two amino compounds were determined by diazotisation in acid solution with a standard solution of sodium nitrite checked against a standard solution of pure sulphanilic acid.

Compound	Yield %	M.P. in °C.	Percentage of Nitrogen		Diazotisation Equivalent	
			Calcd.	Found	Calcd.	Found
$CH_3CONH.\ C_6H_4.\ SO_2N\langle^{CH_3}_{C_6H_5}$	70	153–54	9·20	9·11	..	..
$CH_3CO\ NH.\ C_6H_4.\ SO_2N\langle^{C_2H_5}_{C_6H_5}$	69	125–26	8·80	8·77	..	..
$H_2N.\ C_6H_4.\ SO_2N\langle^{CH_3}_{C_6H_5}$	79	140	10·69	10·63	262	264
$H_2N.\ C_6H_4.\ SO_2N\langle^{C_2H_5}_{C_6H_5}$	82	132–33	10·14	10·13	276	280

The analytical data are summarised above.
My thanks are due to Mr. P. Ramaswami Ayyar for guidance and to Dr. P. C. Guha for kind interest.

Dept. of Pure & Applied Chemistry,
Indian Institute of Science,
Bangalore, (Miss) R. J. Irani.
December 4, 1945.

1. *Curr. Sci., loc. cit.*

STACKBURN DISEASE OF RICE IN BENGAL

In June 1945, a small laboratory experiment was started with a view to determining the relative abundance of pathogenic fungi borne on paddy seed. Forty seeds, some normal in appearance and others discoloured, were sown in Roux tubes on cotton soaked in distilled water. The tubes were all plugged and sterilised before use. In all, 21 seeds failed to germinate. All these eventually became covered with mycelium. In some cases, this mycelium was white, and on examination was found to bear, singly, on the tips of conidiophores not readily distinguishable from the mycelium, almost hyaline spores, rather resembling in shape those of *Alternaria*, club-shaped, septate, with an extremely long, septate "tail", the cells of the spore proper being constricted at the septa, with the second or third cell from the base often considerably larger than the rest. The fungus will be referred to for the moment as the "white mould". The distribution of fungi amongst the 21 non-viable seeds was as follows:

Helminthosporium oryzæ Breda de Haan—6.
Curvularia lunata—4.
White mould fungus—7.
Common moulds—4.

Out of the 19 seedlings which germinated (and which, naturally, eventually sickened through unfavourable conditions for development in the test-tubes) ten bore minute black sclerotia on the coleoptile, first leaf and roots. Four of these seedlings were removed and placed in a moist chamber. All developed the mycelium of the white mould fungus, with typical caudate conidia. Pure cultures were obtained and readily formed both sclerotia and spores on potato dextrose agar.

Germination tests were carried out on seeds of six varieties of paddy in petri-dishes. Five hundred seeds of each variety were used. Table I indicates the number of cases of seedlings showing each of the three fungi.

Table I

Incidence of Helminthosporium oryzæ, Curvularia *and white mould in* 500 *seeds of each of six varieties of paddy.*

Variety	*H. oryzæ*	*C. lunata*	White mould
Latisail	31	45	42
Kumargorh	62	12	28
Asra	10	12	19
Patnai 23	42	5	12
Nigersail	12	25	45
Du Lar	29	15	12

The fungus bore an unmistakable resemblance to that figured by Tullis (1936) and tentatively identified as *Trichoconis caudata* (App. and Str.) Clements, the sclerotium-forming fungus which causes seedling blight and stackburn disease (Tisdale, 1922) of rice in the United States of America. This fungus was originally described as *Piricularia caudata* with the conidial measurements 9-12 × 36-45 μ and the filiform seta 35-45 μ long. The measurements of spores of our white mould, including the appendage, taken from infected material in a moist chamber was 12·6 × 146·2 (8·5-15·7 × 103·2-172·7) μ, the difference in length being due to the extreme length of the

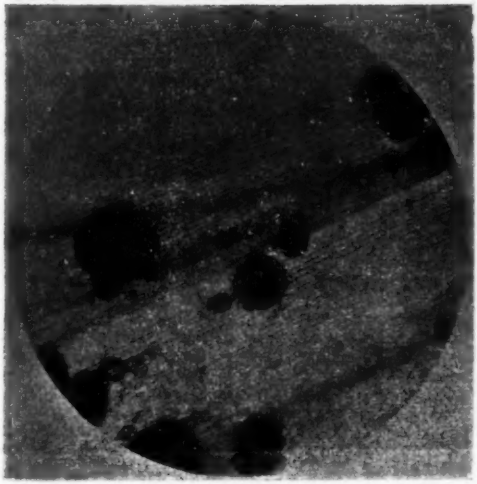


FIG. 1

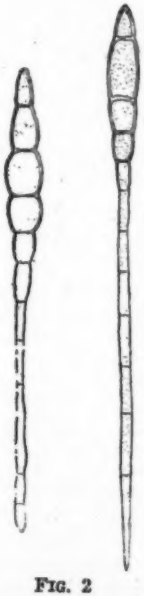


FIG. 2

appendage (Fig. 1). The sclerotia (Fig. 2), which were black, almost spherical, and more or less imbedded within the host tissue, and which had a somewhat reticulated wall, measured 124 (52-195) μ. With some reservation (in view of the difference in spore size) we follow Tullis (*l.c.*) in regarding this fungus as *Trichoconis caudata* (App. and Str.) Clements. It was found on diseased leaves in the field quite frequently before carrying out the experiments recorded above, but was regarded as insignificant until it was seen to be similar to that causing stackburn disease in the United States of America. The damage caused by the disease in Bengal has yet to be determined and the description of the various symptoms of the disease on the plant and the seed is reserved for a fuller study.

G. WATTS-PADWICK.
D. GANGULY.

Bengal Agricultural Institute,
Tejgaon P.O.,
Dacca (Bengal),
October 22, 1945.

1. Tisdale, W. H., 1922, "Seedling blight and stackburn of rice and the hotwater seed treatment," *U.S.D.A. Bull.*, No. 1116. 2. Tullis, E. C., 1936, "Fungi isolated from discoloured Rice Kernels," *U.S.D.A. Tech. Bull*, No. 540.

A STUDY OF THE FACTORS RESPONSIBLE FOR THE COLOURS OF SOILS OF C.P. AND BERAR

THE colour of the black tropical soils has been the subject of diverse views, and various theories have been advanced to explain their characteristic black colour. The earliest one of these sought to attribute the colour to titaniferrous magnetite (Annet[1]), but has been shown to be restricted in its scope, as this component is not of universal occurrence in all black soils. Humus by itself cannot be considered as the black colour component as its amount in tropical conditions is never pronounced.

The black soils of C.P. and Berar, studied by the author, are known to have been derived from different types and systems of rocks like the trap and the various mixed sandstones, derived from the Vindhyan and the Gondavana systems. The nature of the parent rock, which varies widely in the chemical composition such as the Ca and Mg content, cannot, therefore, explain the formation of black colour. More recently workers[3,5] in India have propounded the view that the colour is due to the humus in a fully saturated condition or to the clay-humus complex. Full experimental proof in support of these views is not, however, available.

For arriving at any definite conclusion it is necessary to isolate the esential colour constituent and eliminate the subsidiary factors by analytical methods as far as possible. To begin with, therefore, the mechanical fractions of the soils were separated without drastic pre-treatment and the colour of each fraction recorded by a method based on Whittles.[6] It was found that the clay fraction alone was black in colour while the other fractions, viz., the silt and the sand had ashy-grey and brown tinges respectively. All the black soils studied had a clay percentage of over 50 per cent. As such it is safe to conclude that this fraction alone contributes to the black colour of these soils.

The effect of the removal of humus on the colour of the soils was studied by treating the soils and their clays with H_2O_2. The colour change after the treatment was recorded by the disc technique. It was found that there was no material change in colour by this treatment showing that appreciable amounts of

organic matter are not removed by oxidising with H_2O_2. Actual determinations showed that not more than 33 per cent. of the organic matter could be decomposed by this treatment.

Sodium hydroxide solution as prescribed by Arnold and Page[2] was found to be more effective in this respect, as much as 86 per cent. of organic matter being removed. In case of the clays of these soils all the organic matter was removed by the treatment. The black soils and their clays treated with this solution were found to lose their characteristic colour, the residues being of a grey or brown colour, while the red and the yellow soils were not affected by the treatment.

It is thus amply clear from the above experimental evidence, that the clay in association with the humus as clay-humus complex is responsible for the colour of black soils. These soils have alkaline reaction, a high content of exchangeable bases (mostly Ca), which condition is known to be favourable for the formation of the clay-humus complex.

The influence of the SiO_2/R_2O_3 molar ratios on the colour of soils has been studied by previous workers, but a comparison of the ratio (see table) of black soils with that of soils of other colours showed that there is hardly any variation in this respect from soil to soil to account for such colour variations.

Soils	SiO_2/R_2O_3 molar ratio in clay	Total Fe_2O_3 (HCl soluble)	Hematitic free Fe_2O_3	Limonitic free Fe_2O_3
Black soils—				
1. Black cotton soil	3·00	9·37	3·28	2·30
2. Kabar soil	2·57	10·80	2·33	4·14
3. Kheri ,,	2·79	7·23	2·09	1·27
4. Kanhar ,,	2·50	6·74	1·17	1·99
5. Mariar ,,	..	5·84	1·77	0·98
Red soils—				
6. Hill top soil, Nagpur	1·99	25·6	18·6	4·92
7. Wardi soil (very light red)	2·49	6·53	2·52	2·53
8. Bhata soil	..	24·4	16·16	8·02
Yellow soils—				
9. Dorsa soil	2·10	6·25	0·69	3·23
10. Sehar soil	2·21	4·26	0·76	2·24
11. Matasi soil	2·33	3·11	0·55	2·13

The investigation on the black colour of soils is not complete without reference to the other colouring constituents, chief of which are the oxides and the hydroxides of iron. The effect of removal of these by Harada's[4] method was, therefore, studied in the various soils. It was found that after the removal of the oxides and the hydroxides of iron, the residues from black soils were still black whereas the yellow and the red soils completely lost their colours, the residues being light sandy or not coloured. The colour of the red and the yellow soils is thus principally due to these iron compounds.

Actual estimations of free iron oxides and hydroxides show that the black soils also contain appreciable amounts of these constituents. These amounts are comparable with those of other soils, with the exception of two soils of a distinctly lateritic nature.

The figures of analysis in the table show that the red soils are rich in hematitic iron oxide while the yellow soils contain most of the free iron oxide in the limonitic form. It is interesting to note in this connection that the yellow soils occur in regions where the agricultural practice keeps the soils submerged for a good period of the year indicating that a process of slow hydration of iron oxide accompanies prolonged contact with water.

In finding the factors responsible for the colours of soils it, therefore, appears necessary to take into consideration the effects of various colouring constituents, in order to find out the preponderating component which is likely to mask the colours of other minor factors, and thus give the final colour to the soil.

The author is thankful to Mr. R. C. Shrivastava, I/C Agricultural Chemist to the Government of C.P. & Berar, and Dr. K. G. Joshi, Provincial Biochemist, Compost Scheme, for the interest shown by them in the work.

Agricultural Res. Institute,
Nagpur, R. H. JOSHI.
October 15, 1945.

1. Annet, *Memoirs of the Dept. of Agr.*, 1920. 2. Arnold and Page, *Journ. Agr. Sc.*, 1930, 460. 3. Desai, A. D., *Bulletin. Dept. of Agr.*, No. 10, H.E.H. the Nizam's Govt. 4. Harada, M., *Journ. Am. Ch. Soc. Abstracts*, 1937 **31**, 2559–60. 5. Venkatramiah and Raghavendrachar, *Proc. Assoc. Ec. Biol.*, **5**. 6. Wnittles, *Journ. of Agr. Sc.*, 1931, **21**.

RACIAL SIGNIFICANCE OF PATELLAR GROOVE

THE racial differentiation of the Indian and the European femora depends mainly on the increased range and frequency of the movements of the knee joint in the former as compared to the latter.[4] The constant and forceful impact of soft structures and the tendons around the knee joint leaves permanent features, of not inconsiderable anthropological interest, which are invariably identifiable, and often measurable in the dry bones. Thus a large number of variations in the lower end of femora have come to be recognised in Indians[1,2,3] and some other races, modern and ancient.[4,5] To these variations may be added that in the depth of the patellar groove of the femur.

The depth of the posterior end of the patellar groove in front of the intercondylar notch was measured in 200 femora from Punjabis and expressed as a fraction of the 'true' length of the femur.

It was found that in 62 per cent. of bones examined the groove was deeper than 1/45 and in 3·5 per cent. shallower than 1/60 of the length of the femur. In Europeans[4] the corresponding figures are 3 per cent. and 7 per cent. respectively. This shows that in a very large percentage of European femora (97 per cent. and 93 per cent.) the patellar groove is

neither too deep (1/45) nor too shallow (1/60); while in 62 per cent. of Indian bones the groove was deeper than 1/45 and in only 3·5 per cent. it was shallower than 1/60 of the length of the bone.

Considering the distribution of the femora according to the depth of the groove it was found that in 87 per cent. the groove was deeper than 1/52 and in 13 per cent. shallower than 1/51 of the length of the bone. Corresponding figures for Irish[4] are 50 per cent. and 50 per cent. for English[4] 30 per cent. and 70 per cent. respectively.

The conclusion from the above results appears to be obvious. In the majority of Indian femora the patellar groove is deeper than it is in Europeans. The increased depth is attributable to more frequent rubbing movements of the patella, on the patellar groove, in the much more active knee joint of an Indian.

Department of Anatomy,
Dow Medical College,
Hyderabad (Sind), M. A. SHAH.
October 9, 1945.

1. Siddiqui, M. A. H., *J. Anat.*, 1934, **68**, 331. 2. Shah M. A., *Ibid*, 1942, **77**, 110. 3. Shah, M. A., *Cur. Sci.*, (in Press) 1945, 4. Martin, C. P., *J. Anat.* 1932, **66**, 371. 5. Siddiqui, M. A. H., *Ibid.*, 1936, **70**, 410.

A NOTE ON THE CULTURE OF *OSPHRONEMUS GORAMI* LACEPEDE IN CEMENT CISTERNS*

MASONRY cisterns, usually regarded as unsuitable for Gourami culture, have been found suitable provided adequate weedage is offered.

A pair of adult Gourami, measuring 10" and 10½", was introduced in June into a cement tank in the Municipal Park at Rajahmundry. The tank cuts a cross-shape internally and covers an area of 40 square feet with 3½ feet depth. The sides are vertical and cemented and the bottom is evenly plastered. The water is let in through a pipe arrangement at the bottom. A 3-inch layer of fine sand was spread at the bottom to plant *Hydrilla* in clusters.

The fish were found to feed on the tender foliage of *Hydrilla*. To keep them in prime condition the supplemental diet of ground-nut oil-cake was also given. In the last week of September the fish were restless and the female was suspected to guard a particular spot amidst the vegetation, while the male was vigilant some two feet away from the female. After the fry emerged, a search was made for the nest near the suspected spot. The trailing shoots and the foliage of *Hydrilla* were knitted nicely to form a thick cover with an opening facing the centre of the cistern. The nest was 6 inches above the ground. It was vertically drawn out and had no distinct form.

Fingerlings numbering 30, of the size of 1" to 1½" were seen frequently coming to the surface of water. Gourami can thrive and breed in masonry tanks of fair depth, if any suitable material like *Hydrilla* for nest-building is furnished.

Inland Fisheries,
Nellore, V. D. SPURGEON.
July 13, 1945.

* Published with the permission of Director of Industries and Commerce, Madras.

SYMBIOSIS IN SPITTLE INSECT* *PTYELUS NEBULOSUS* FABR.

THE present communicaiton deals with the symbiosis of *Ptyelus nebulosus* Fabr. belonging to the family *Cercopidæ*. The two tumours of Bacteriotomes are on either side of the abdomen and as usual differ in size. The one nearer to the skin is coloured ochre to brown. The other which covers the former tumour as seen from inside is reddish in colour. The intensity of the colour of the tumour is more in the nymphal stages than in the adult stages of the insect. While dissecting it was observed that the brown tumour is a very delicate one for it disintegrates into small bits when kept for sometime in tapwater, but this is not the case with the red tumour.

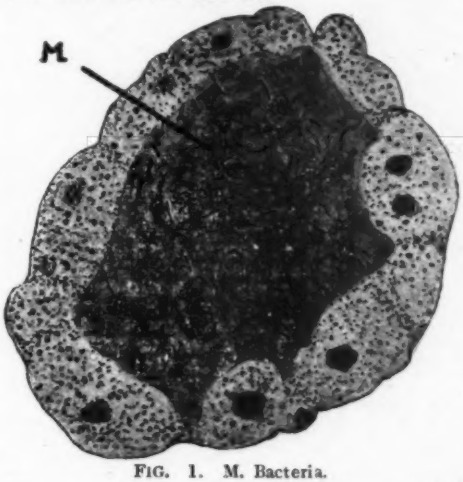


FIG. 1. M. Bacteria.

Fig. 1 stained in Heidenhain's hæmatoxylin (without counter-stain) represents a cross-section of the red tumour. Syncetium is full of bacteria, its circumferance is surrounded by cells not infected by bacteria but the cell

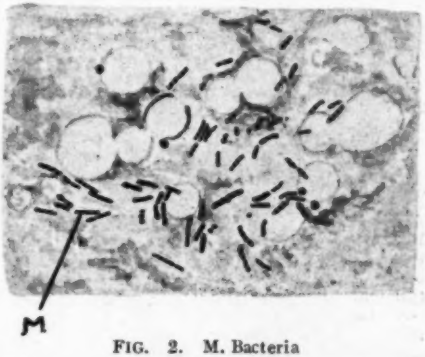


FIG. 2. M. Bacteria

margin is very indistinct. Fig. 2 represents a smear from the red tumour, the smear was fixed with Bouin's fluid and subsequently stained with Giemsa as mentioned in my previous

* Identification of the insect has yet to be confirmed.

communication (*Current Science*, Vol. 14, R.P. 210-11, August 1945). The bacteria are not uniform in size as has been noticed by several workers on Symbiosis. These bacteria stain red with Giemsa. According to the previous work done in this Laboratory these bacteria are real Symbiots and are probably responsible for the pigment production. This hypothesis can be incidentally conformed by the observation that during the nymphal stages the red bacteriotome is more intense in colour than in the adult stage.

With regard to the brown tumour it may be pointed out that it is pressed between the chitinous skin and the enveloping red tumour.

FIG. 3. P. Unknown Cell-inclusion

Fig. 3 represents cross-section of the brown tumour stained in Heidenhain's hæmatoxylin. The cell-inclusions are not clearly defined like many others recorded in the literature on Symbiosis. Buchner and his school look upon these cell-inclusions as fungi of unknown classification. However, a smear from such a tumour when stained with Giemsa imparts the cell-inclusions the plasmatic blue colour,

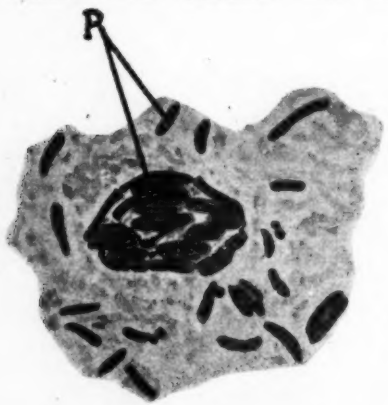


FIG. 4. P. Unknown Cell-inclusion.

which is distinct from the red nuclear stain given to bacteria. Fig. 4 represents such a smear. The cell-inclusions are very near in shape to those figured by Buchner for *Aphrophora alni* (Fig. 9 c, p. 112, Z. *f. Morphologie und Œkologie*, 1925).

The work was done in the laboratory of Dr. S. Mahdihassan and my thanks are due to him and to Professor B. K. Das.

Osmania Medical College,
Hyderabad (Dn.),
October 18, 1945.

MOHANBABU NAIDU.

PALÆOLITHIC SITES IN THE NELLORE DISTRICT

IN *Current Science* for February 1940 I had the privilege of making a preliminary statement about Palæolithic Sites in the Nellore District. I wish to report a site recently found which is of special interest because it seems to offer a geological clue to the age of stone-age tools in this part of India. The Madras trunk road, south of milestone 149, crosses an artificial drainage channel which serves to divert rain water into a tank east of the railway line which here parallels the highway at about a half-mile distance. The area between road and railway is reserved forest, a sparse jungle of thorny shrubs. From the channel the surface of the ground slopes very gently upward to the south toward a low ridge of laterite. Northward from the channel the surface is nearly level with, in places, drainage toward the channel. Material removed from the channel is heaped on either side. The excavation cuts across a deposit of stiff red clay which varies in thickness from a few inches to as much as eight feet. Beneath the clay is a thin layer of laterite overlying greatly decomposed granitic rock. In this channel we have found 140 stone-age implements of which the greater part are listed in Memoir No. 68 of the Archæological Survey of India.* A considerable number have been found *in situ* in the red clay at depths of 2 or 3 feet. But recently I found a fine quartz implement imbedded in this clay at no less than seven feet below the surface of the surrounding jungle floor. A geologist competent to study the terraine and discover the source of the clay and estimate its rate of deposit might have a valuable clue to the antiquity of stone-age man in this area. I have seen no place where an equal opportunity is offered and hope someone will be interested to look into it.

The implement is a *coup de poing* made by crude primary flaking on a quartz cobble stone. It is 11·3 cm. long, 8·3 cm. wide and 4·8 cm. thick. It has a heavy pebble butt and might be classed as Acheulean in type.

FRANK P. MANLEY.

Ramapuram,
Nellore Dist.,
October 17, 1945.

* *The Manley Collection of Stone Age Tools*, by A. Aiyappan and Frank P. Manley.

ON THE OCCURRENCE OF A GYNOPHORE IN *DRABA* SP. FROM KASHMIR, WITH REMARKS ON THE PHYLOGENY OF THE GYNOPHORE IN THE CRUCIFERÆ

THE presence of a gynophere in *Draba* sp. is not peculiar to the Cruciferæ, but a prolongation of the axis at the base of the ovary is recorded by Schulz (1919, 1935) in about a dozen different tribes of this family, *viz.*, Brassiceæ, Cremolobeæ, Romanschulzieæ, Streptantheæ, Sisymbrieæ, Mathioleæ, Arabideæ, Lunarieæ, Stanleyeæ, Hesperideæ, etc. A short or a long gynophore is described in *Brassica elongata, Diplotaxis harra, D. tenuifolia* (Schulz, 1919, p. 105), *Cremolobus, Lunaria, Macropodium, Stanleya, Thelypodium* and *Warea* (Schulz, 1936, p. 241). Although a gynophore is already known in Drabeæ, so far as the author is aware, it is not previously recorded in *Draba muralis* L. or *D. nemoralis* L. Dr. Stewart told me that our plant is not a normal healthy specimen but it is diseased. The present record is, therefore, an abnormal case and the abnormality is probably a result of hypertrophy caused by the disease.

FIG. 1

FIG. 2

Fig. 1 is a half-natural size photograph of a floral branch of *Draba* sp., which according to accompanying notes on the sheet, was collected by J. R. Drummond on June 30 in 1902 from the Kashmir Valley; it was found growing in a flax field near Shopyon at an altitude of 6,000 feet. This plant, together with several other specimens, was sent to India after an incomplete identification at Kew and bears the number 13956 Ex. Herb. Kew. It was made available to me through the courtesy of Dr. R. R. Stewart, who received for identification several incompletely determined specimens from Drummond's Kashmir collections from Principal J. C. Luthra of the Punjab Agricultural College, Lyallpur, to whom this specimen was returned after study. On an enquiry kindly made at my request by Dr. Stewart from Kew the above identity of the plant was confirmed.

In Fig. 1, especially near the apical parts of the inflorescence axes, there are seen several flower-buds which show distinct gynophores; however, they are not so well marked in fruits. The flower-buds and fruits on dissection showed a structure typical of the genus *Draba*, and although on account of the absence of leaves and for want of exact information regarding the habit of the plant it is not possible to identify the specimen with more certainty, it shows a great resemblance to *Draba muralis* Linn. or *D. nemoralis* L. This identification was kindly confirmed by Dr. Stewart and our figured specimen is a branch of either of the two species bearing abnormal flowers.

In a natural size photograph of a part of the specimen (Fig. 2) the nature of the raceme is clearly seen; and several fruits (marked with arrows) are seen to possess at bases of the siliquas small stalks which are undoubtedly of the nature of gynophores.

It is interesting to note that a short or a long gynophore is recorded in as many as 12 out of the 19 tribes into which this family is divided. In the more primitive tribes of the family, *e.g.*, Stanleyeæ, Romanschulzieæ, Streptantheæ, Cremolobeæ, etc., the gynophore is well developed and occurs more commonly, but in the intermediate forms, *viz.*, Brassiceæ, Lunariæ, etc., a short gynophore is found in a few genera. In Sisymbrieæ, Mathioleæ, Arabideæ, Hesperideæ, etc., which are the higher tribes of the family the gynophore gets very much reduced in size and completely disappears in most cases. In Drabeæ, which is believed to be one of the most highly developed tribes of the Cruciferæ, a very short gynophore may be present in primitive genera, but it is so far previously not recorded in the genus *Draba*.

The present abnormal occurrence of a gynophore in *Draba*, which, according to Schulz (1936, p. 266), is one of the most highly evolved genera of the Cruciferæ, seems to throw important light on the phylogeny of the gynophore in this family. Although abnomalities, as a class, are generally treacherous guides to affinities, very often they provide interesting evidence regarding the phylogeny of certain organs and throw important light on their phylogenetical significance.

From the above facts regarding the occurrence of a gynophore in the Cruciferæ it may

be concluded that this organ is a primitive structure found in the lower tribes of the family, but in the more specialized forms, where it is either altogether absent or occurs only as a very short stalk at the base of the ovary, it has undergone suppression. The occurrence of a gynophore as an abnormality in one of the most highly evolved genera of the family is evidently a reversion to ancestral character found normally in the primitive members of the Cruciferæ; this reversion has probably taken place as a result of hypertrophy caused by the disease.

Further support for the conclusion that absence of the gynophore is an advanced character is found in the Capparidaceæ, a family with well-acknowledged affinities towards the Cruciferæ and one regarded as more akin to ancestral forms from which both the families have arisen. In some species of Cleome, notably *C. monophylla* and *C. Stocksiana*, the ovary is either sessile or it may bear a very small stalk at its base. In *Cleome viscosa* the ovary, as a rule, is sessile, but occasionally one comes across a rudimentary stalk at its base. In the primitive tribes of the Capparidaceæ the gynophore is not only well developed but is of a very common occurrence.

In the end I wish to record my most grateful thanks to Professor B. Sahni, sc.d., f.r.s., and my friend, Dr. V. Puri, d.sc., of the Meerut College, for helpful suggestions and expert advice. I am also thankful to Dr. R. R. Stewart, Principal, Gordon College, Rawalpindi, who went through this note and kindly confirmed the identification of the specimen.

Dept. of Botany & Geology,
University of Lucknow, G. S. Puri.
October 22, 1945.

* Schulz, O. E., *Cruciferæ in Engler's Pflanzen reich*, **1919, 5,** 105, and *Cruciferæ in Engler-Prantl Naturliche Pflanzen Familen.*" 1936, Band **17B,** 244-266.

D. D. T. AND CATTLE TICKS

In view of the encouraging results reported to have been obtained with D.D.T. in various spheres of entomological research, the author, at the suggestion of Major Ch. Williamson, Animal Husbandry Commissioner with the Government of India, carried out some preliminary trials at the Imperial Veterinary Research Institute, Mukteswar, to determine the effect of this drug on cattle ticks in India.

Emulsions of D.D.T. were prepared in turpentine and in kerosene oil, using liquid soap as an emulsifying agent in each case. The concentrations employed were 0·1, 0·2, 0·5 and 1·0 per cent. Cattle heavily infested with ticks (*Boophilus australis* Fuller) were sprayed in batches with different concentrations of these emulsions. It was found that (*i*) D.D.T., in emulsion with turpentine at concentrations of 0·2 and 0·5 per cent., destroyed ticks in their larval, nymphal and male adult stages. The percentage of ticks destroyed varied from 80 to 90 per cent. on sprayed cattle. Engorged female ticks did not seem to be affected, except that they failed to oviposit when incubated at 22° C. or 37° C. after each spraying; (*ii*) a single spray of D.D.T., in emulsion with kerosene oil and liquid soap at a concentration of 0·5 per cent., destroyed all stages of ticks within a period of a few minutes. In this case cent. per cent. tick mortality was observed. Turpentine or kerosene oil in emulsion with liquid soap when sprayed without the D.D.T., have practically no tickicidal value.

Experiments showed that, in the case of ticks, D.D.T. acted as a stomach poison and not as a contact poison or a repellent. The drug is non-poisonous to human beings and livestock.

As a point of practical utility, it may be mentioned that D.D.T. emulsion can be used in the form of a hand-dressing, thereby eliminating the cost and complications involved in cattle-dips and sprays.

The writer is indebted to Major Williamson for his occasional suggestions during the progress of these experiments.

Imperial Veterinary Research
Institute, Mukteswar, B. N. Soni.
October 18, 1945.

IMPORTANCE OF YELLOW CHANG-SHAN AND ITS PLAN FOR MASS PRODUCTION

The term 'Yellow Chang-Shan' (*Dichroa febrifuga* Lour.) is Chinese classics and for thousands of years this plant has been the sole remedy for malaria. Owing to negligence very few Chinese medical men have ever adopted its use. Quinine from overseas has been decreasing in quantity on account of war and Chinese scientists have now come to give their special attention to this particular plant.

'Yellow Chang-Shan' is in reality the true variety of 'Chi-ku Chang-Shan' meaning 'Chicken bone Chang-Shan' in the 'Pen-Tsao', the well-known Chinese medical book.

This plant is adopted to shady place where soil is rich in humus. It grows well in wooded valleys above sea-level of from 1,000 to 1,800 metres. So Golden-Buddha Mountain of Nan-Chuen Hsien, Szechwen Province, is the ideal place for growing this plant.

The medical property of this plant is in its roots but its stems and leaves are also used by country people to cure malaria.

This plant is reproduced asexually but seeding process is now also under experimentation.

For mass production of this medical plant, the Ministry of Forestry and Agriculture and the Rear Service Corps agree to take the whole responsibility.

The plan for the production of this plant comes under two main divisions: plant-breeding and four-year plantation. When these come to completion this plant drug will suffice for the use of all who have malarial attack in this country.

To execute this plan 'The Golden-Buddha Mountain Chang-Shan Experimental Station', established by the Ministry of Forestry and Agriculture, has been assigned the special responsibility. Moses S. D. Swen.

The Golden-Buddha Mountain
Chang-Shan Experimental Station,
The Ministry of Forestry and
Agriculture, China.

REVIEWS

Radium Therapy—Its Physical Aspects. By C. W. Wilson. (Chapman and Hall, London), 1945. Pp. 224. Price 18 *sh.*

Of the many special branches of modern Medicine none is better built on a foundation of scientifically established facts than the radiation therapy. This has been accomplished by those few physicists who have been guiding and co-operating with the radiologists in this speciality. Dr. Edward Chamberlain, a leading Professor of Radiology of Philadelphia, recognises this fact when he says: "Physicists have not only supplied us with answers to our questions and apparatus to our needs; often they have had to show us what we wanted, what our needs really were." And Dr. Wilson's book furnishes another illustration of this close and fruitful co-operation between the physicist and the physician in the domain of radium therapy.

If radium therapy developed more slowly than did roentgen therapy it is not only because radium was very expensive and difficult to obtain but also the problems of practical dosimetry and the creation of increasingly flexible and effective apparatus have been more difficult of solution with the tremendously more penetrating gamma-rays from radium. The crucial subject in this domain which still needs further study and greater clarification is the measurement and control of gamma-ray dose and its distribution in the irradiated field. Dr. Wilson has done well to clearly stress this point and to indicate the need for further investigation.

The book is on the whole a well-balanced account of the fundamentals of radiation physics and their application to the solution of problems of treatment with radium and as such will be found most useful by curietherapists. The important question of protection from gamma-rays of both the patients and the staff is thoroughly discussed in the light of the recommendations made in 1943 by the British X-ray and Radium Protection Committee.

However, the usefulness of the book would have been decidedly greater had Dr. Wilson gone more critically and in greater detail into the question of radon service and the requirements of an up-to-date radon laboratory. There is no doubt as to the general agreement at present that the future of radium in therapy is more towards interstitial and contact application and less in the form of bombs for telecurietherapy. Supervoltage apparatus are already available that are capable of producing X-rays of one to two million volt energy. These units are safer, enormously more powerful and are very much less expensive than any existing radium bomb and patients suitable for telecurietherapy are already being advantageously treated with such apparatus. It is, therefore, not unreasonable to assume that the future use of radium is certain to be for contact application in which form it has some well-established advantages over any other form of radiation therapy. Radon service is definitely superior to the direct utilisation of radium salts in any medical centre of importance which aims at making the most of its resources for extensive radium therapy.

R. NAIDU.

Colorimetric Analysis. By Noel L. Allport. (Chapman and Hall, Ltd., London), 1945. Pp. xii + 452. Price 32 *sh.*

The ceaseless search of the analyst for simpler and more rapid methods of analysis has resulted in a widespread adoption of physical methods such as colorimetric, conductometric and potentiometric methods. The popularity of colorimetric methods can be attributed to the improvement of apparatus of measuring the absorption of light, and colorimetric methods have been developed for practically every element, radical and physiologically active compound. There is a large volume of literature devoted to the application of colorimetric methods of analysis in every field of scientific research.

Unlike the monumental work of F. D. Snell and C. T. Snell, the volume under review does not attempt to give a theoretical discussion of the methods or a description of the instruments employed for the determinations. The author's aim has been to offer a practical and concise handbook on colorimetric analysis. Only those methods which are known to be reliable and of which the author has first-hand knowledge as a research chemist in the *British Drug House, Ltd.*, have been included in the book. Special attention has been given to the application of colorimetry to the examination of natural and manufactured products. The limitations of each method are indicated, thereby enabling the analyst to choose the one which satisfies his requirements. When the colour tests are of general utility, the descriptions have been supplemented by detailed procedures for their more important applications. The approach is critical throughout.

For convenience, the book has been divided into five sections. The first deals with the colorimetric determination of some important metallic elements chosen for their biological or industrial significance. The platinum group of metals have been omitted as gravimetric methods are more reliable. Altogether 25 metals have been dealt with and 357 references to original literature have been included.

The second section refers to the methods for the estimation of acid radicals. Most of the methods are widely used in biochemical investigations and their application demands elaborate care. As many as 15 radicals have

been dealt with including tartarates, salicylates, oxalates, lactates, p-hydroxy benzoic acid and its derivatives. 121 References are included in this section.

Substances of clinical and biochemical importance with special reference to biological fluids such as urine, blood and spinal fluids, are covered by the third section. The 30 fluids to which attention has been given have been chosen for their importance and their representative character. 304 References are included in this section.

Section IV deals with the methods for alkaloids, hormones and vitamins. 12 Important alkaloids and 3 hormones are included. Colorimetric evaluation of hormones has not, so far, led to any important results and the author has rightly included only 3 of them. Among the vitamins, vitamin A and its precursor carotene, vitamins of the B group, and vitamin E are dealt with exhaustively. There are 184 references in this section.

The last section includes methods of determination of miscellaneous substances whose selection has been based mainly in consideration of their general interest, and also with a view to make up any possible omissions in the earlier sections. Some 20 substances have been treated under this head and there are 109 references to original literature.

The volume would have been self-contained and its usefulness enhanced, if a chapter on instruments had been included. Colorimetric analysis is tending towards instrumentation. The accuracy of the estimations which has been stated to be ± 5 per cent., has been greatly improved by the use of filter photometers and spectro-photometers. Nessler's tubes are only relics of the past and objective methods of measurement by the use of photoelectric cells have largely eliminated personal errors and fatigue factors incidental to visual observations. The author has chosen to keep out nephelometric methods from consideration. While it is true that nephelometry is not colorimetry, the two methods have a family affinity. Both are based on the measurement of light that reach the observation point after passing through test solutions. The measuring equipment is more or less similar in both cases, and many of the nephelometric methods are of great value and convenience. The volume is well written and documented. There are very few books of this type in the English language, and it should prove useful and handy in all analytical and research laboratories.

A. K.
B. N. S.

Manufacture of Lead and Slate Pencils, with Special Reference to India. By N. N. Godbole. ("*Leader*" Press, Allahabad), 1945 Pp. 40. Price Rs. 4.

It is difficult to understand the purpose of this publication. In his Foreword, which has been written because the author feels that "it is customary for an author to write a foreword", it is stated that the contents were published in a popular magazine nearly three decades ago. A study of the booklet makes one feel that they should have been left where they were. There is little in the book that is of practical value to a prospective pencil manufacturer. The author's advice is to import refined graphite "rather than take up the responsibility of purifying the Indian graphite", to import wood, and with these to manufacture pencils with the machinery that may be fabricated in India. In view of this advice, one should not expect the author to suggest processes for refining graphite or for treating the large quantities of second grade wood available in India to render them suitable for pencil manufacture. The only reference to the purification of graphite, which is casually mentioned, is "a simple process in which water is largely employed and on which it floats though specifically heavier". It is stated that in America "graphite purified by the air-blowing method is used". Apart from these illuminating references, there are no suggestions of practical value with regard to the purification of graphite. Regarding softening of wood, the author makes a passing reference to softening in Japan "by a process of heating". Clay of the right kind is said to be available in plenty in India. But one looks in vain for a definition of the characteristics which renders a clay suitable for pencil manufacture.

The publication is mostly padded with personal anecdotes of the author's ramblings in the forest regions of India in quest of pencil woods, which have been described as "both sensational and romantic" and which sometimes have "shaken the life out" of the author. There are several references to the author's opinions regarding forest managemnt in various areas. These anecdotes may be quite amusing but are, by no means, beneficial to the reader. The four pages of the leaflet on "Indian Woods for Pencil Making", recently issued by the Forest Research Institute, give more information of value than the bulk of the book under review which deals with the author's cursory survey of Indian forests.

The omissions in the book are too many to be dealt with in a review. The book covers but 40 pages. The price is too high for a book which at best may be only of historical interest.

A. K.
B. N. S.

Root Disease Fungi. By S. D. Garrett, M.A., D.I.C. "Annales Cryptogamici et Phytopathologici," Vol. 1, 1944. (Waltham, Mass., U.S.A., The Chronica Botanica Co., Calcutta: Macmillan & Co., Ltd.). Pp. xv + 177. $4.50.

This is the first of the publications under the series "Annales Cryptogamici et Phytopathologici", edited by Frans Verdoorn, and forms a notable contribution to the study of the epidemology of root disease fungi, detailing methods of control. The book is divided into fifteen

chapters with suitable subclassifications and subject and author indices. The author of the work, Mr. S. D. Garrett, who is an acknowledged authority on the subject, reviews our present knowledge of the root disease fungi in an elegant manner as to arouse further interest in the subject in all those interested in plant pathology.

The profound influence exercised by environmental factors on the parasitism of soil-borne fungi, as first pointed out by the Wisconsin school of investigators under Prof. L. R. Jones, has become an established fact. The saprophytic microflora of the soil-inhabiting fungi, differentiated by Waksman and others into "soil inhabitants" and "soil invaders", is shown to play an important part in the control of the root diseases. The fungi of the soil inhabitant type, might, according to their nature, spread external or internal to the host. In the former case the disease usually spreads by means of rhizomorphs, the extent of the spread of the disease being determined by the "food base". In those cases where the spread of the disease is internal, as in tracheomycoses, the spread of infection is brought about after the disintegration of the parasitised tissues.

In Chapters 4 to 7, the various soil conditions that influence the spread of the disease are reviewed. These exert direct influence on the growth and spread of the fungi in those cases where the mycelium is external, and indirect in those fungi which are internal within the host by affecting its metabolism. The soil temperature, for instance, might not only determine the intensity of infection, but also the type of infection within the host. The other factors such as, humidity, texture of the soil and others which also take part in influencing the severity of the disease are discussed.

The perennation of the root parasitising fungi within the soil over long periods as active saprophytes on decaying matters, or surviving within the invaded tissue saprophytically by the formation of sclerotia, etc., and their importance in the control of the disease are finely dealt with. The various scientific methods of control of root diseases are explicitly presented in the last seven chapters. The crop rotation, which is the oldest and most efficacious method known, use of healthy sets and seeds for propagation purposes along with other sanitation methods, are discussed in detail. The problems concerning root disease fungi of plantations in virgin areas as expatiated by Napper and others, control of root infections by isolating the infected plants by trenching and other special methods of root disease control by amelioration of soil temperature, etc., are bound to be of great interest to plant pathologists. The book is very well produced, and may be heartily recommended to all those workers interested in the study of soil-borne fungi.

M. J. T.

Village Industrialisation. By Sir M. Visvesvaraya. (A.I.M.O. Brochure No. 3, Bombay), 1945. Pp. 33. Price Re. 1-4-0.

Plans for an all-out drive for the industrialisation and properly balanced rehabilitation of the country, both agriculturally and industrially, are all very thoughtfully drawn up and almost to the last detail with samples of tabular forms for stock-taking, investigations, etc. Here are some excerpts. "The fact should be brought uncompromisingly to the cognisance of our rural population that they as a community have been left weak and inefficient because there is no tradition or organisation in local areas to enable the people to work in combination or co-operation and to put forth disciplined labour or observe regular hours of work. By observing regular hours of daily toil, whatever be the vocation, by adhering to business hours fixed for the beginning and end of the day's labour, and by constant attention to self-education and promoting the working capacity of head and brain, the purchasing power of every village will grow and the homes of even the very poor will begin to glow with happiness and good cheer. ... No rural family or individual should be without some subsidiary occupation to employ its or her spare hours. Cottage industries like home gardening, poultry keeping, spinning and hand-weaving, bee-keeping, mat making, and also breeding of sheep or pigs, etc., are within the grasp of every village resident, even the very poorest. With a little enterprise, numerous similar occupations can be created ... As the rural population is not generally used to development work of any kind, special measures will be necessary, according to the conditions of each unit area, to induce the population to adopt and work the scheme ... Unless people in each locality give up unprogressive habits and begin to think for themselves and increase their knowledge, skill and income, they will have no future."

Sir Mokshagundam appeals to the co-operation of all the intelligent and progressive elements of the population to plan and execute and improve by studying the results, on the lines suggested in this pamphlet, an organised movement for making the people industry-minded.

The reviewer is not a pessimist, but believes that an even more radical movement is necessary for making the people realise the evils of idle-leisure, and over-indulgence in coarse enjoyments such as in cinema theatres or in listening to endless music programmes on the radio, etc. These entertainments have their place but one cannot help remarking that they are making detrimental inroads into the lives of many rural and urban communities and are tending to wean them away from even the few traditionally practised useful hobbies they were hitherto deriving pleasure from. People have almost stopped to think for themselves, as everything is thought out for them over the radio and the press. The ennobling pleasures to be derived from useful hobbies, social service, study circles, etc., are belittled by the obviously more intense pleasures that can be more easily had, and at so very little cost!

We do hope Sir M. Visvesvaraya's sage counsels will be taken up in earnest by many local communities. Several practical suggestions for the selection and adoption of small-scale industries are included.

M. A. G. Rau.

Scope of Chemical Industry in India. By H. G. Biswas, M.Sc. (The Bengal Chemical and Pharmaceutical Works, Ltd., Calcutta), 1945. Pp. 44. Price Re. 1-4-0.

The author has in this monograph surveyed rather succinctly and largely in the light of his experiences, the present and future prospects of the chemical industries in this country. The inorganic and organic industries are dealt with separately, and under the subsections of (*a*) mineral acids, (*b*) salts and alkalis and (*c*) metals in the former, and in the latter as (*a*) acids, alkaloids, sugars and essential oils of vegetable origin, (*b*) fermentation industry, (*c*) coal-tar distillation products and allied industries and (*d*) synthetic organic chemicals of aliphatic group of the industries dependent upon them.

The chemical industry occupies a key position in the economy of every country, and its scope can be truly said to be unlimited because of the number of varieties it already comprise and the possibilities for fresh developments with progressive research, both in the pure and applied sciences. All of this is intimately bound with a sound knowledge of chemical engineering design and the facilities to fabricate the required equipments in this country. Mr. Biswas has however not touched on this aspect of the problem. Within the limitations he has set himself, he has reviewed the present production and the possible demands in the country for various chemical products and has emphasised those that may be regarded as urgent. It is needless to single out any of his suggestions for special mention. Quite naturally this author from Bengal has laid great stress on the utilisation of the coal resources of the country, and he has rightly also drawn the reader's attention to the great scope for fermentation industries.

This informative review with its exhortations to the reader will be found to be a useful matter for study and application.

M. A. G. Rau.

Disposal of War Surplus Stores and Ordnance Factories. By N. D. Sahukar. (A.I.M.O. Monograph No. 8, Bombay), 1945. Pp. 19. Price Re. 1-0-0.

Mr. Sahukar reviews a live problem of the day. All these surplus materials are, in the main, tax-payers' property, and it behoves that the disposal of these surpluses must be carried out on a planned basis, involving the least loss in cash to the tax-payer, the minimum of disturbance to the normal level of trades and industries, and the greatest benefit to the community as a whole.

The several Government enactments in U.K., U.S.A., and India, in order to achieve their disposal successfully, are surveyed and compared, and the imperative need for co-opting unofficial public men from trade and commerce and of technical personnel, is strongly urged. The author rightly points out that sufficient consideration has not been given by the government for the utilisation of some of the stores by educational institutions. There is bound to be many an item of stores, and particularly those of a scientific nature, which could well be utilised by such institutions. As far as possible government might donate such stores as a gift to them. If for any reason, it is considered that a free gift of such stores could not be made, the first option for their purchase, and at a special reduced price, could and must be given to these educational institutions. No better way of utilising surplus stores could be found than this. After all, educational institutions which can use surplus stores are very few in the country, and it is the government's duty to consider their claims over surplus stores in preference to the claims by other public bodies or Provincial and State governments.

The utilisation of ordnance factories for fruitful purposes is another matter of great importance. Many of them are first rate chemical industries, with several valuable equipments of multiple use, acquired at priority rates and pressed into service. A co-ordinated policy of reconstruction and reorientation of the output from these factories for meeting various civilian needs is a matter of primary concern, and should also be properly undertaken in co-operation with non-official public and technical personnel.

This pamphlet forcibly points out the need for a greater realisation of the various possibilities for utilising these surpluses to the greatest benefit of the nation.

M. A. G. Rau.

The Directiveness of Organic Activities. By E. S. Russell, O.B.E., D.Sc., F.L.S. (Cambridge University Press.) Pp. 196. 8*sh.* 6*d.* net.

The biologist, whether he takes to routine teaching or does intensive research, hardly finds any time to examine or review at frequent intervals the enormous data that is accruing in the various biological fields of thought. In giving food for thought from this angle, the reviewer considers that Dr. Russell's little book is brilliantly and authoritatively written. The author, with very apt examples, mostly Zoological than Botanical, takes the reader into a vastly intriguing field of what appears to be speculative thinking but which, as a matter of fact, is a logical theme supporting his conclusion that the mechanistic outlook must be mistaken, and that the teleological character of biological events must be accepted. Directiveness, or purposiveness, of different biological activity in the maintenance and restoration of structural and functional norms; in the satisfaction of metabolic needs; in the relation of goals to biological ends have been superbly presented with choice examples from the animal and plant kingdoms.

One cannot more aptly summarise this book than in the author's own words, "the mechanistic conception of the living organism being inadequate and restrictive, it is necessary to replace it by a more realistic conception, which shall take account of the fundamental or irreducible characteristics of living things,

those, namely, which are shown by no inorganic system, and without which no living organism is conceivable, characteristics therefore, which cannot have arisen during the course of organic evolution, for life of any degree presupposes them".

Thus, the philosophical implications presented in the book are likely to have strong supporters for and against and whatever side one might take there would be no stinting of praise to the author on the excellent examples chosen for a forceful exposition of his viewpoint.

T. S. SADASIVAN.

A Laboratory Handbook of Organic Qualitative Analysis and Separations. By V. S. Kulkarni. (Dastane Brothers' Home Service, 456, Raviwar Peth, Poona 5), 1945. Pp. 40. Re. 0-15-0.

The text presents material for college students of B.A. and B.Sc. classes for their guidance in organic qualitative analysis and separations. The first 16 pages introduce the student to a simple scheme for identification of simple organic compounds. Pages from 16 to 28 present a list of commonly occurring organic substances, their formulæ, melting-point or boiling-point, and in some cases, their derivatives. Fairly complete and accurate directions for the preparation of derivatives of common organic substances are given in pages from 28 to 37. The suggested methods enable the student to work successfully without constant assistance of the teacher. The rest of the pages contain a scheme for the separation of simple organic mixtures.

In the choice of substances and the general reactions given, the author has obviously in view, the reduced syllabus given for practical course for B.Sc. chemistry during war-time. Nevertheless, the reactions given and the methods suggested are fairly comprehensive and will serve the needs of the college students of B.A. and B.Sc. classes. The booklet on the whole provides a fairly well balanced introductory course in organic qualitative analysis for the college students. Further, textbook writing industry in this country has to make much headway. Books of the type under review show a happy augury and deserve encouragement.

M. S. MUTHANNA.

The Grasses of Burma. By D. Rhind. (Baptist Mission Press, Calcutta), 1945. Pp. 99. Rs. 5 or 7*sh.* 6*d.*

The work is a compilation by the author of available information found scattered in Government bulletins, forest publications and various other published and unpublished records. The compilation is meant to serve the purpose of a guide-book to grasses of Burma rather than of an exhaustive work of reference. The list of species recorded has been compiled by examination of specimens that had been preserved in the herbarium of the Mandalay Agricultural College, Burma, and some of the important herbariums in India. In listing the grasses, the bamboos in which Burma abounds and which comprise the major part of the flora of the country, have also been included. Descriptive notes follow the lesser known species of grasses of Burma but no descriptions accompany the better known ones and those previously described in readily accessible floras. This perhaps accounts for the small size of the publication. The importance of the present publication lies in having brought together information on grasses of Burma that were previously scattered and were inaccessible. It thus provides a handy source of reference to workers on grasses. However, it is to be hoped that a more exhaustive work on the grasses of Burma, including a description of those collected but yet undescribed species would be forthcoming in the future.

A glossary and a list of fungi found on grasses in Burma form useful additions at the end.

L. S. S. KUMAR.

Sixth Annual Report, 1944—*The Tuberculosis Association of India.* (Published by the Tuberculosis Association in India, New Delhi.)

This Report consists of an introductory section dealing with the object of the Association followed by the annual report of the activities carried on by the Association, statement of accounts and several appendices dealing mainly with summaries of the reports of the Provincial and State Tuberculosis Associations.

As in the previous few years, the work of the Association during 1944 has been carried on under difficult war conditions. However, the quality and quantity of the work has been maintained at a satisfactory level. During the year under report there has been a further increase in the tuberculosis institutions in India; eight clinics, four sanatoria and two hospitals have been opened. One clinic and one sanatorium are under construction and proposals for the opening of two more clinics and three hospitals are under consideration. Information received from Administrations and States, as a result of enquiry, show that very useful work has been carried on by a majority of them, such as starting of sanatoria, building of clinics and special wards, hospitals, etc., while some States are awaiting the end of the war for active antituberculosis work. Due to the war, it had not been possible to appoint a full-time Medical Commissioner; but the Association has been fortunate in securing the services of Dr. P. V. Benjamin, who devoted a considerable portion of his time to the affairs of the Association and visited several centres to tender expert advice. One great difficulty that is being encountered is the death of trained workers and adequately qualified specialists. This is being partially met by holding post-graduate refresher courses and training health visitors, but for various reasons these courses had to be limited. The T.D.D. courses instituted by the Madras Government have been exceedingly popular. The Mysore Government has recently introduced a T.D.D. course and

most probably Calcutta and Delhi will follow soon. The full development of the Publicity and Propaganda Section, whose value is generally acknowledged, has been greatly hampered on account of the war, but the activities are carried on by means of pamphlets, charts and other useful materials. The Indian Medical *Gazette* has been of the greatest service to the Association, by publishing special Tuberculosis Numbers for the past seven years, but it is felt that the time has arrived when the Association should have a journal of its own.

During the year under report the Lady Linlithgow Sanatorium has further consolidated its position. The New Delhi Tuberculosis Clinics have continued to play important role in the prevention, diagnosis and treatment of tuberculosis and also by arranging home visits and contact examinations, training post-graduate students, health visitors and nurses and continuing the scheme of organised home treatment. A summary of reports of the Provincial and State Tuberculosis Associations is given in Appendix VIII, and a perusal of the same shows that uniform progress has been maintained by them in antituberculosis campaign and there has been further stabilisation and co-ordination of the work of the various institutions.

N. N. D.

India and International Economic Policies. (All-India Manufacturers' Organisation, Bombay), 1944. Pp. 97. Price Rs. 2-8-0.

This interesting brochure contains a statement of the views of the All-India Manufacturers' Organisation on the Agenda of the International Business Conference held in November 1944 at Rye, New York.

In the introductory pages the need for a new conception of India in the international world is pointed out and the basic assumption underlying the views of the A.I.M.O. is explained, *viz.*, the establishment of responsible National Government for the whole country. There are nine chapters and they are devoted to the consideration of provisional items included in the Agenda for the Business Conference, *viz.*, maintenance of private enterprise, commercial policy of nations, international currency problems, protection of international investments, industrialisation of new areas, shipping, aviation and world supplies of materials.

The national point of view is emphasised throughout, pointing out the need for intensive industrialisation so as to provide full employment and for treating India as an equal and independent unit by herself, participating freely in any international agreement relating to trade, industrial policy, shipping, aviation or currency arrangements. International co-operation in the disposal of raw materials for the rehabilitation of war-devastated countries and the establishment of a stabilised currency are advocated as necessary for the establishment of a better basis for international economic relations in the world. The urgent need for the liquidation of Sterling Balances is also pointed out. Several chapters contain, at the end, a summary of the views and this is very helpful to the reader.

The defence of private enterprise in an age, wherein economic forces appear to be swinging to the other end, cannot be accepted in total. Making a reference to American experience during war-time, it is urged that the evils of private enterprise may not exceed its good points. They advocate the maintenance of private enterprise in the initiation and operation of industries, trade and commerce and services including transport by air, sea or land. Many may not agree with the authors on this point. There are such statements elsewhere in the book which set the reader thinking about the correct economic policy for the country.

The get-up of the book is very attractive. Taking into consideration the intentions of A.I.M.O. in publishing their books and pamphlets, the price for this publication must be considered high.

The book may be read with profit by all those interested in the economic advancement of India.

B. R. S. R.

A Text-Book of Heat. By G. R. Noakes, (Macmillan and Co., Ltd., London), 1945. Pp. viii + 469. Price 10*s.* 6*d.*

In spite of the large number of text-books of heat now available, this new text by the author of the well-known books on Electricity and Magnetism and Light forms a welcome addition to the literature. The same up-to-dateness of outlook and treatment and attention to practical and everyday applications that were noticed in the same author's two previous books are noteworthy even in the present volume. Mr. Noakes proves himself to be a very good teacher both by the choice of topics and the method of handling them. In the present book the principles which guided the design of apparatus and the limits of accuracy obtainable are prominently dealt with. The ground covered seems to be ample for the B.Sc. Pass standard of our Universities, and the large number of problems provides ample opportunity for the student to make himself thorough with the subject. As compared with other text-books this volume is characterised by descriptions of most modern work which cannot fail to produce in the student the conviction that the subject is a live and growing one. The treatment of the dimensions of thermal quantities and the sections on meteorology are very useful additions to the usual run of subjects. The arrangement of material, particularly in calorimetry, is somewhat unusual and mixed up, and from the present writer's point of view, the frequent insistence on the difference in the various thermometric scales rather than on their approximation to one absolute scale may lead to greater confusion than to clarity. Some topics like the description of the Callendar & Griffiths' bridge, the derivation of van der Waals' equation and the

proof of Cornot's theorem will gain in clearness if the present treatment is somewhat amplified. The printing shows a number of instances of dropped letters, reminding us of the war-time production of the book. The reference to Fig. 159 has the letters C_1, C_2 &c., in wrong order and on p. 365 we have $(\theta-\theta)^{5/4}$ instead of $(\theta-\theta)^{5/4}$. These minor blemishes can easily be remedied in the next edition. We have no hesitation in heartily recommending this modern text to the attention of teachers and students of the Pass degree standard and we would also wish Honours students to go through the work if they want to obtain a clear grasp of the physical principles underlying the subject.

T. S. S.

The Arc Spectrum of Iron, FeI—Part I. By H. N. Russell and (Miss) C. E. Moore; and Part II. By (Miss) Weeks. *Transactions of the American Philosophical Society*, Vol. 34, Pt. II. (The American Philosophical Society, Philadelphia), 1944. Pp. 97. Price $2.25.

Eminent investigators have, from time to time, reviewed the state of our knowledge regarding the structure of the spectra of various elements; in one such recent survey, Dr. Shenstone has graded the then available knowledge of the arc spectrum of iron as 'B', where the letters 'A', 'B', 'C', 'D' are used to denote progressively incomplete knowledge. The iron arc is the source of most of the lines that have been chosen as secondary standards of wavelength, and the sun's spectrum contains numerous lines of iron. It was, therefore, a serious gap in our knowledge which was indicated by the letter B in Shenstone's survey. Now a veteran in the analysis of spectra—Dr. Henry Norris Russell—has filled the gap and raised the FeI spectrum to a grade better than 'A' by publishing the present monograph with the collaboration of Miss Moore and Miss Weeks. That other pioneer in the analysis of complex spectra—Dr. Catalan—has been responsible for much of the advance embodied in the monograph, and the authors say that his name would have figured as joint author but for the difficulties of postal communication in these times of international stress and strife. We can form a conception of the singular devotion of these investigators to the pursuit of knowledge when we realise that their interest in the spectrum of iron has remained unabated during decades despite the vicissitudes of peace and war. And when the authors say that the arc spectrum of iron still promises 'attractive' and 'remunerative' problems, we can appraise the significance of the adjectives in the light of their love of knowledge for its own sake. The lavish scale of American equipment for research is here exemplified by the results on the Zeeman effect of iron lines, studied by means of the great Bitter magnet producing 83000-87000 oersteds and Dr. Harrison's automatic measuring machine which prints on a film the wavelengths of lines to three decimals and also their intensities measured photoelectrically. The substantial advance embodied in the monograph can be seen from the fact that it lists 464 levels (while Goudsmit & Bacher's book gives 287), accounting for 3606 lines observed in laboratory sources and 1254 lines observed only in the solar spectrum, while the Zeeman effect of 1038 lines has been listed leading to 'g' values for 392 out of the 464 levels. Apart from the wealth of these data, there is the high accuracy, the average error of a level being only $\pm 0{\cdot}05$ cm.$^{-1}$ Stress must also be laid on the fact that grouping into term multiplets and assignment of electron configurations have been carried out almost exhaustively, with full details of the evidence for the correctness of the assignments. The ionisation potential is estimated at 7·858 volts. The terms, in spite of their numerousness, are found to accord with Hund's theory except for two levels designated X_2 and X_3 which seem to be difficult to reconcile with its predictions. As the authors say, not much remains to be done by way of analysis unless a new source is discovered, which can produce iron lines with a profuseness approaching that found in the sun.

The tables present one peculiarity, viz., that the levels are listed according to parity and multiplicity and not according to energy values. Thus the even levels classified into singlets, triplets, quintets, septets, occur in this order and then the odd levels in a like order. From one point of view this is an advantage but the arrangement fails to show the importance of the various levels as being concerned in the emission of observable lines. The wavelength data extend from 11973 Å to 1855 Å, various sources having been laid under contribution. King's temperature classification has also been included.

In such an extensive mass of data so carefully compiled, it is idle to try and locate errors without detailed checking, but one or two obvious misprints that caught the eye of the writer may be mentioned. Thus in Table 7 on p. 118, the first column, first line has $n^*=1{\cdot}3170$ while it should be 1·3130. In the second line the limit is given as 63630 while calculation gave it as 63310. In the third line, third column, Δn^* ought to be 1·0720 instead of 1·0723. In Table 10, p. 121, the number of ^5P terms to be expected is given as 6, and the number of ^5P terms observed is given as 7. This seems to show that more terms have been found than theory predicts, but the contradiction is not a real one. The number of ^5P terms assigned to the configuration concerned is, according to Table A, 6 and not 7, the 7th ^5P term being assigned to a different configuration.

Summing up we have no hesitation in saying that the paper is a model of what such work should look like, and that too a model worthy of close scrutiny but probably hard to imitate by anyone undertaking similar studies. Every practical spectroscopist should possess a copy of the paper and con over it time and again with the certainty of deriving profit each time from such a study. The price is probably not high for such literature.

T. S. S.

SCIENCE NOTES AND NEWS

Protection against Leeches.—Messrs. M. J. Narasimhan and M. J. Thirumalachar, Bangalore, write to us as follows:—

For people living in the tropical rain forest regions and plantation areas, leeches have been a source of trouble during wet weather and an uncontrollable source of worry to field workers. In the arecanut gardens and coffee plantations of Mysore, the workers and labour class suffer from leech-bites to a great extent resulting in bleeding and loss of blood and often suppuration of the wound. Many ingenious devices are taken against leech-bites such as tobacco, soap, lime solution, etc.; but, during the heavy monsoons owing to the splash of rain and slushy condition of the soil none of the precautions taken have proved really effective. The only effective way is to pick them off the leg and throw them away, but this leads to divided attention between work and leeches.

An ointment prepared by the School of Tropical Medicine, Calcutta (as reported in the *Plantens' Chronicle*, January 1, 1945) composed of 1 part of cinnamon oil and 7 parts of vaseline was found effective for 24 hours, but it has to be used with care, since it is an irritant to the mucous membrane.

The following preparation was given for trial to few members of Botanical excursions party, Central College, who recently went into a heavily leech-infested area. To 300 c.c. of hot castor oil or melted petroleum jelley, enough bees-wax is added to get the consistency of a paste on cooling. Just before this mixture hardens, 5 c.c. of pyridine (C_5H_5N) is added and stirred well to ensure thorough mixing up of the ingredients. The preparation is cooled and stored in well-stoppered bottles. For use, a small quantity of this paste is smeared on the surface of the boots or legs. It has been found that the leeches on approach, first get upon the boots and seem to get benumbed, for after a few seconds they drop on the ground falling as if in a stupor and do not recover for some time. When applied to bare feet, it does not seem to cause any irritation or injury to the skin at that concentration. Boots or shoes with a good coating of this paste (with higher concentration of pyridine if necessary) retain the repellant reaction for a fairly good number of days (as yet undetermined) and splashing through water or walking through slushy places does not in anyway appear to lower the repellent effect of the paste.

Mr. B. Krishnamurthy has asked us to insert the following:—

"The work of investigation published under the title 'Alternate media for large-scale rearing of the Rice-moth (*Corcyra cephalonica* St.) in the work of mass-production of the egg-parasite *Trichogramma minutum* R.,' in the October 1945 issue of *Current Science* was initiated by Mr. M. J. Narasimhan, Director of Agriculture in Mysore, who first suggested the use of Tapioca as the bulk food material in place of Jowar."

University of Bombay, Department of Chemical Technology.—The Annual Report for 1944-45 just received shows that two new sections of (1) Plastics, Paints and Varnishes, and (2) Oils, Fats and Soaps have started functioning from June 1945. "The Plastic Section will train graduates in chemistry in this new and increasingly important branch of technology, so that fully qualified personnel will be available for developing the Indian plastic industry. The object of the Oils Section is to assist the Indian fatty oil industry to expand in new directions and to utilise fully the fat resources of the country. The syllabuses provide for an adequate training in chemical engineering for the students of the two new sections."

During the year under review the construction of the buildings, and the equipment of the laboratories with gas, electricity, vacuum, etc., were completed, the laboratory plumbing, steam installations, and certain other items having been carried out departmentally.

A number of scholarships are awarded to the students by the Department (10), Sir Dorabji Tata Trust (5), and other charitable Trusts (10), and so also a large number of Fellowships for research.

Eleven original contributions were published during the year, and a number of others are ready for or awaiting publication. As usual a large number of papers deal with the chemistry of dyes, wetting agents, etc.; new lines of work are also reported on synthesis under high pressures and temperatures, and on foods and drugs.

Among the technical investigations completed may be mentioned the standardisation of natural indigo; as a result of numerous experiments, it has been possible to develop a process for preparing natural indigo in a standard form of uniform quality and strength. Other investigations deal with the suitability of electro-tin plate for storing hydrogenated oil, the examination of corrosion and scale formation in the boiler of one of the moffusil mills, etc.

Dr. Frans Verdoorn, Editor of *Chronica Botanica* and Botanical Adviser to the Board for the Netherlands Indies, writes that according to reports received from Holland, Australia and Java, the scientific institutions in the Buitenzorg area (West Java) are relatively in good condition. The classic collections in the herbarium, as well as the grounds of the famous Botanic Gardens at Buitenzorg, have not been damaged to any considerable extent (it also seems that herbarium material has not been transferred to Japan). The rich library of the Department of Economic Affairs and most of the experiment station buildings are also in tact. The following may be quoted from a letter from Dr. C. G. G. J. Van Steenis, the well-known authority on Malaysian botany, just received in the U.S.A.:— "I lost altogether one year work, but worked harder than in any other period ... finished several papers, and am almost ready with my

Cyclopædia of botanical collections, and book on Malaysian Plant-Life ... Was released as a prisoner of war, August 11, 1942, again in jail, December 14, 1942 to April 13, 1943, worked again to August 13, 1945. Now again interned ... The biologists, Dr. W. K. Huitema, Ir. P. H. Heckenberg, Dr. J. H. G. Ferman, Dr. M. P. Both, Ir. C. van der Giessen, and P. van der Groot, have died. Of many others, especially Dr. M. A. Donk, Dr. P. J. Eyma, and T. H. van der Honert, not yet any news. Dr. O. Posthumus, H. C. D. de Wit and my wife still working. Hope to be released soon ..."

National Institute of Sciences of India.—At a meeting of the Council of the National Institute of Sciences of India, held on Monday, the 19th November 1945, at the Delhi University, Delhi, the ballot papers were scrutinised and the following gentlemen were declared to have been elected Fellows of the Institute :—

Ordinary Fellows.—(1) Dr. I. Banerji, D.Sc., Lecturer in Botany, Calcutta University; (2) Dr. P. B. Ganguli, D.Sc., Principal, Science College, Patna; (3) Dr. S. Ghosh, D.Sc., Professor of Chemistry, School of Tropical Medicine, Calcutta; (4) Dr. P. S. Gill, Ph.D., Professor, Forman Christian College, Lahore; (5) Dr. J. C. Gupta, M.B., Professor of Pharmacology, School of Tropical Medicine, Calcutta; (6) Dr. S. S. Joshi, D.Sc., Principal, College of Science, Benares Hindu University; (7) Dr. B. C. Kundu, Ph.D., F.L.S., Professor of Botany, Presidency College, Calcutta, (8) Dr. C. Mahadevan, D.Sc., Assistant Superintendent, Hyderabad Geological Survey, Hyderabad—Deccan ; (9) Dr. P. C. Mahanti, D.Sc., F.Inst.P., Lecturer in Applied Physics, Calcutta University; (10) Dr. U. S. Nayar, M.A., Ph.D., Head of the Department of Statistics, Travancore University, Trivandrum; (11) Dr. M. V. Radhakrishna Rao, M.B., B.S., Ph.D., Clinical Research Officer, Haffkine Institute, Parel, Bombay; (12) Dr. M. L. Roonwal; Ph.D., Assistant Superintendent, Zoological Survey of India, Benares Cantt.; (13) Dr. R. E. M. Wheeler, D.Litt., Hon. D.Litt., Director-General of Archæology in India, Simla.

Honorary Fellows.—(1) Prof. A. F. Blakeslee, Smith College, Northampton, U.S.A.; (2) Dr. R. A. Millikan, President of the California Institute of Technology; (3) Prof. P. Niggli, Professor of Mineralogy and Petrology, Federal Polytechnical University and University of Zurich.

The Bombay Metallurgical Society.—A Society of the above name has been established at Bombay with 77 members, 11 associates and 18 firms engaged in metallurgical work, as subscribers.. *President* : Prof. N. P. Gandhi, formerly of the Benares Hindu University; *Secretary* : Mr. Y. M. Mehta, Partner, The Standard Plaster Works, Bombay. Those interested may obtain further particulars from the Secretary, Kennaway House, Proctor Road, Girgaon, Bombay 4.

The Meteorological Office Colloquium, Poona.—Mr. P. R. Pisharoti spoke on "The Theory of Cyclones" on 2nd and 9th November 1945, and Dr. R. Ananthakrishnan "On Fluctuations of pressure and temperature in the atmosphere" on 23rd and 30th November 1945.

Sir M. Visvesvaraya, K.C.I.E., LL.D., has been re-elected unanimously as President of the All-India Manufacturers' Organization for the year 1946.

The Sixth Annual Conference of the All-India Manufacturers' Organization will be held on Friday, 28th, and Saturday, 29th December 1945, in Madras at the Banqueting Hall, Government House, under the Presidentship of Sir M. Visvesvaraya, K.C.I.E., LL.D. The first day's session starts at 3 p.m. on Friday, 28th December 1945. The Conference will have special importance in view of the fact that with the cessation of the war many vital transition problems connected with the industrialization of the country which are engaging the attention of the Government and the industrialists will be discussed.

Imperial Chemical Industries (India) Research Fellowship.—The Council of the National Institute of Sciences of India, Calcutta, has awarded an Imperial Chemical Industries (India) Research Fellowship, carrying a stipend of Rs. 400 per month, to Mr. Rama Nagina Singh, M.Sc., to conduct research work on Algology under the direction of Dr. Yajnavalkya Bharadwaja, University Professor of Botany, Benares Hindu University, for two years in the first instance.

In 1938 the Burmah Oil Co., Ltd., embarked upon a large-scale survey, employing the latest known methods in the world, and at the outbreak of war, they had as many as seventeen separate geophysical parties at work in India and Burma. The survey had covered 330,000 square miles, 22,000 observation stations had been set up from which gravity measurements were made and the cost so far has been Rs. 45 lakhs. As soon as conditions permit, the B.O.C. are planning to employ the latest methods to try to find new oilfields. Amongst other companies, who engaged in oil exploration in India, is the Attock Oil Company.

ERRATA

Vol. 14, No. 9 (September 1945)

Page 229, Note on "Quantum Mechanical Theory of the Joshi Effect," column 1, line 21: *read* "ionised" *for* "isolated".

Page 245, Note on "Apparent Carotene and Vitamin C in Dehydrated Vegetables", in Table I heading, *read* "moisture-free basis" *for* "moisture basis".

Vol. 14, No. 10 (October 1945)

Page 261, Note on "A Relation between the Sheer Constant C_{44} ... Metals", column 2, last line of the table, under the heading ($r \times 10^8$ Calculated), the figure for K should be 4·87 in place of 8·87.

Page 276, Review of the book *A Class-Book of Botany*, para 2, line 15 (running on p. 277), *read* "petaloideæ" *for* "uitaloideæ".

1943-45 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for The Current Science Association, Bangalore

Regd. No. M. 2799

Current Science

Vol. 14, No. 12 DECEMBER 1945 Pages 313-343

REJAFIX . . . . . .

COMBINED OFFSET AND LETTER-PRESS PRINTING MACHINE

On . . . .

GLASS
CARDBOARD
CELLOPHANE
CELLULOID
METAL-FOIL
ALUMINIUM
PAPER
PORCELAIN
ENAMEL
SYN. RESIN
WOOD
WOVEN FABR
OILCLOTH
LEATHER
BOTTLES
AMPOULES
JARS
TUBES
BAGS, BOXES, CARTONS, LABELS
CARDS, MEMOS, WRAPPERS
RECEIPTS, FORMS, ENVELOPES
MIRRORS, BRUSHES, PENCILS
TIES, HATS, CAPS
ELECTRICAL ACCESSORIES
TINS, PENS, TOOLS, ETC., ETC.

- Long or Short Runs At Little Cost
- Two or More Colours At Once
- 4 Ways of Printing On One Machine
- Large Articles Easily Printed Size not Limited to Printing Area
- Not an Expenditure But a Profitable Investment
- Good Clear Printing on Flat, Round or Irregular Surfaces

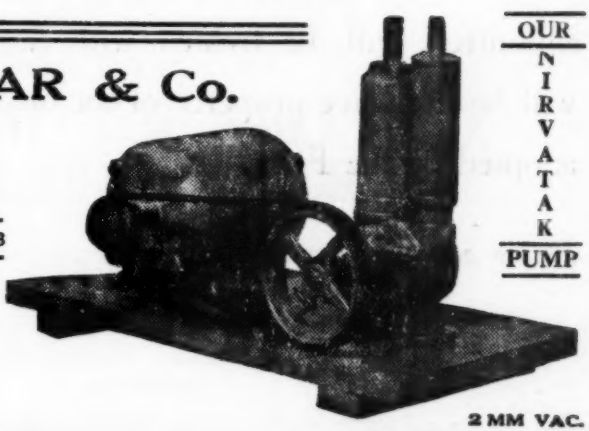
For Particulars please write to Sole Distributors :

RAJ-DER-KAR & Co.

COMMISSARIAT BLDG.
HORNBY Rd., FORT
BOMBAY

Phone : 27304 Gram : TECHLAB

We also fabricate :
FILTER PRESSES
TABLET MACHINES
EPIDIASCOPES
WATER STILLS
NIRVATAK VAC. PUMPS



OUR NIRVATAK PUMP

2 MM VAC.

FRUIT EVERY DAY KEEPS THE DOCTOR AWAY

HEALTH is the essence of life. Doctors advise us to eat fresh fruit daily to maintain a good standard of health.

So in any planning for a healthier and wealthier India, intensive development of fruit-farming is essential. Also cultivation must be extended over areas that now lie wastefully barren. But fruit is a perishable crop and must be carried to market quickly. ROAD TRANSPORT would solve the problem, as it reduces handling to a minimum, and is the safest, quickest way to carry the produce to market.

Good communications are essential to the nation's health and prosperity. Railways and Rivers have played and will continue to play an important role. But the Road is at least equally important. Above all else India urgently needs MORE ROADS.

INSERTED BY BURMAH-SHELL TO PROMOTE MORE ROADS & BETTER CROPS

GOOD ROADS ARE AVENUES TO PROSPERITY

The Bangalore Press